

September 1993/\$3.00

Mobile Radio Technology™

The journal of mobile communications technology



Site safety, p. 10

Behind the FCC label
Narrowband technology
Emergency-use repeater
System diagramming
Transmitter noise



Only from antenna specialists...



New! **PRO-5000™** SERIES

No more compromises with quality, performance or value. You get it all with our **PRO-5000™** VHF and UHF professional mobile antennas. All new A/S design from the ground-plane up for optimum reliability.



- **Triple O-ring seals** — runs rings around others for superior protection from water and other contaminants.
- **100% factory-tuned and locked coils** for long-term frequency stability.
- **All internal connections** soldered or press-fit for electrical integrity.
- **Clean, contemporary, functional design**
- **Stainless steel whips:** VHF models DURA-CON® plated for highest conductivity.
- **Power rated** 150 Watts; **VSWR** less than 1.5:1; **Gain** 3 dB (VHF); 3 dB or 5 dB (UHF).

Unique! **DURA-FLEX®** SERIES

For industry standard performance and beyond — especially in duplex communications systems and high vibration environments — choose



Antenna Specialists' exclusive **DURA-FLEX-**equipped mobile antennas.

- **Exclusive A/S DURA-FLEX** elastomer shock absorber completely eliminates RF duplex noise associated with conventional metal springs, especially with high vibration vehicles or terrain.
- **Over 30 VHF and UHF models**, all standard mounting configurations, for virtually any professional application where reliability is mandatory.
- **Electrical and mechanical specifications** meet or exceed all industry standards.
- **Stainless steel whips**, in choice of high-conductivity DURA-CON® or black chrome finish.



the antenna specialists co.

a member of the ALLEN TELECOM GROUP



® Stripes of Quality™

30500 Bruce Industrial Parkway, Cleveland, OH 44139-3996 • Tel. No. 216/349-8400 • Fax No. 216/349-8407.
© 1993 by the Antenna Specialists Co.

Circle (1) on Fast Fact Card

The 10-site radio controller



Vega's C-5111 10-line/4-frequency console

Vega's Model C-5111 compact, easily rack-mounted, ten-line/four-frequency radio control console provides instant PTT, timed mute, and other most-needed features. This tone-format console allows you to quickly select one or any combination of up to 10 remote base stations. A second speaker allows you to monitor (with individual volume controls) any combination of those 10 stations that are not already selected for TX/RX control. Instant PTT switches allow immediate response to a call on a particular "selected" or "unselected" line, without disturbing the programming of the "selected" simulcast group or line.

Standard features available on the cost-effective and versatile C-5111 console include:

- **SELECTED** switches for selecting any combination of lines for transmitting and receiving
- **UNSELECTED** switches for monitoring any combination of unselected lines

- **TX ALL (simulcast) switch** for selecting all lines for both transmit and receive
- **RX ALL switch** for monitoring all unselected lines
- **Separate speakers and volume controls** for "selected" (TX/RX) and "unselected" (RX-only) audio
- **GROUP SELECT switch** for easy selection of TX/RX line combinations
- **TIMED MUTE switch** to mute "unselected" audio temporarily
- **Separate volume controls** for each "unselected" line
- **Instant-PTT switches** for each line
- **Line-activity LEDs** (function on all lines, selected or not)
- **Heavy-duty 120/240-V_{ac} power supply** (also runs on 12 V_{dc})

Options

- **DCA-3 external three-line adapter** for DC-format lines

- **Gooseneck and desk microphones, headsets, footswitch**
- **DTMF pad**
- **Cross mute**
- **Clock, audio-level bargraph, and cross-mute indicators**
- **Rack-mount kit**

The C-5111 has the flexibility to accommodate most any multiline console requirement. Call 1-800-877-1771 (toll-free) now for full details on the C-5111 console.



a **MARK IV** company
Signaling Products Group

9900 East Baldwin Place
El Monte, California 91731-2294
Telephone: (818) 442-0782
Toll-Free Telephone: 800-877-1771
Fax: (818) 444-1342
FaxBack: (818) 444-2017
Toll-Free FaxBack: 800-274-2017

Circle (4) on Fast Fact Card

features

10 Site safety: Planning for success

Donald E. Koehler

Identify safety hazards, write safety rules and train workers how to eliminate or mitigate the risks posed by safety hazards.

18 Behind the FCC label on a land mobile radio

Rex E. Miller

Here are the procedures that must be followed before radio equipment reaches the marketplace.

22 Narrowband channel signaling demands bandwidth efficiency

Dr. Gregory M. Stone and Karen Bluit

Contrary to popular belief, reducing the channel spacing and transmitter power as the FCC proposes to do in its spectrum refarming project will not increase spectrum efficiency.

36 Intermittent-duty repeater for emergency use

Terry W. Ellis

Modifications to Motorola and General Electric mobile radios convert them into repeaters suitable for emergency use.

44 Fried green transistors

Mike Mekelburg

The benefit of having a system diagram at hand for a service call at oh-dark-thirty outweighs the time and trouble it takes to draw one.

50 IWCE/Fall preview

MRT editors preview the Sept. 21-23 show.

52 Mobile Communications Marketplace preview

MRT editors preview the Sept. 28-Oct. 1 convention.

departments

4 Editorial

6 Calendar

8 Technically speaking

Harold Kinley, CET
Transmitter noise.

64 News

68 Regulating technology

Robert H. Schwaninger Jr.
Lesson No. 1: Follow the money.

72 New products

92 Literature

93 Feedback

94 People

95 Letters to the editor

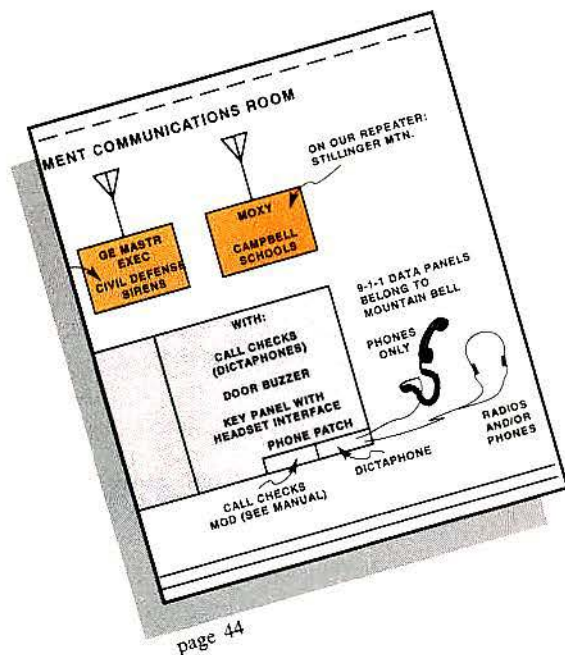
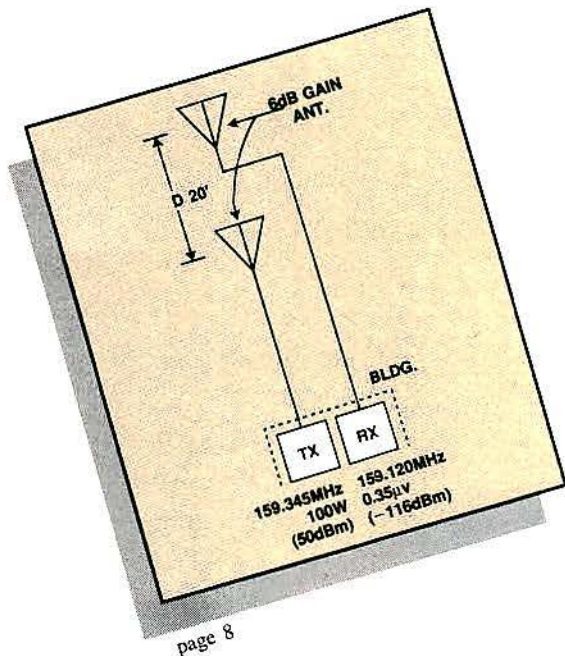
96 Classified ads

112 Ad index/hot line

Find advertisers quickly.

113 What do you think?

Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9800 Metcalf, Overland Park, KS 66212-2215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66282-2960.



On the cover: Employees of Broadcast Communications, New Glarus, WI, use safety equipment and procedures while working on a steel tower. See Donald E. Koehler's article on page 10.

AT LAST, MOBILE DATA & STATUS REPORTING AFFORDABLE FOR SMALLER FLEETS!



The **DATA MESSENGER**™ System

Now, the speed, efficiency and accuracy of a **complete** mobile data system is at the fingertips of even the smallest 2-way radio user. Selectone's new **Data Messenger System** can send up to 8 messages of 140 characters each to every system mobile unit (new or existing, trunked or conventional) with an additional 64 messages stored in queue. This complete turnkey system, armed with Selectone proprietary software provides "handshaking" in both directions which virtually guarantees total communications. The system includes an ST-1010 Base Station Controller, the ST-1000 Mobile Data Terminal, mounting bracket and interconnect cables. Installation is fast and easy, thanks to Selectone's Applications Engineering support.

FOR FULL FACTS, CALL:

- Stores up to 8 messages of 140 characters each.
- Eight programmable user-defined status conditions.
- "Handshake" acknowledgement of all transmissions.
- Back-lit mobile display for easy day or night viewing.
- ANI (Automatic Number Identification).
- Complete fleet status display at base station.
- Compact mobile terminal (6.2"L x 3.8"W x 1.6"D).

Circle (5) on Fast Fact Card

Selectone

Selectone Corporation • 23278 Bernhardt Street • Hayward, California 94545
Toll Free: (800) 227-0376 • Fax: (510) 887-4011 • Phone: (510) 887-1950

Technician association elects volunteer leaders



During its May 1993 meeting, the Association of Communications Technicians' (ACT) volunteer leadership council expanded the council from five to eight members. ACT is a membership section of the National Association of Business and Educational Radio (NABER), Alexandria, VA.

Three council members continue in unexpired terms: Steve Ambo of Dechant Electronics, Wood River, IL; Gary Matheson of ITT Technical Institute, Tampa, FL; and Forrest Collier of Paging USA, Indianapolis.

Re-elected to two-year terms are Thomas Green Sr. of Ranken Technical College, St. Louis; and Jack Ford of Pagecom Systems, Somerset, NJ. Green, the current council chairman, was re-elected chairman for two years.

New council members elected to two-year terms are James C. Folmer of Syntonic Technology, Lanham, MD; and Wayne F. Wantland of the Yakima, WA, city fire department. Ian Wright of Dominion Communications Systems, Colonial Heights, VA, a former council chairman for four years, was elected to return to the council for a one-year term.

ACT members supplied the council with nominations. A two-member committee of council members evaluated the nominations and, following its usual procedure, forwarded to the council for a vote the same number of

names as there were open seats on the council.

New council members

► Folmer is a senior lead technician with Syntonic. His work with the company has included field technical work, service and project management, and engineering responsibilities, depending upon varying customer contract requirements. Including his military service, he has 23 years of experience in radio communications.

Folmer said he joined ACT three years ago to support technician certification, to subscribe to the association's publications and to add another dimension to his credentials.

"Syntonic requires certification for certain job levels and expertise," he said. "I see value to certification, and I joined the council in part to find out what others think about certification requirements. I am concerned that certification may be going to the wayside, and I would like to see it go the other way. Maybe, through ACT and NABER, there is enough influence to increase the certification requirements."

Folmer said he would like to see ACT increase the information it provides for field technicians, whether it be job-related, career-related or helpful in day-to-day tasks.

► Wantland began working for the city of Yakima 11 years ago as an electronics technician, and now is the communication and electronics supervisor in charge of Yakima's C&E service center and the consolidated fire dispatch center.

He is the Associated Public-Safety Communications Officers' (APCO) automated frequency coordination frequency adviser for Eastern Washington, and he is a member of the Region 43 National Public Safety Plan Advisory Committee. He is certified by APCO and NABER as a technician.

Referring to what some see as a diminishing role for technicians in servicing modern two-way radios, Wantland said: "I would like to see the council address the issue of the 'last technician' philosophy that seems to

pervade the industry. Although service centers may have less component-level repair responsibility, the systems and options in the world are so complex that the users need a service center to help them with the decisions facing them."

Wantland said he would like the council to become or to stay active in the regulatory issues that face the industry. "We, as technicians, should be able to offer insight to the FCC and Capitol Hill on these issues from a perspective they will not necessarily get from others," he said.

► Wright, who is vice president of sales at Dominion, began serving on the NABER board of directors after serving the limit of two consecutive two-year terms on the ACT council as its chairman, beginning when the technician association was formed.

Wright said he would like to help ACT's membership grow. In addition, he suggested that ACT publish a single-page hot-issues newsletter. "A technician would skim over something lengthy. But a newsletter that takes five minutes to read and that tells where the industry is going would be helpful." One immediate purpose of such a newsletter, he said, might be to quash some of the inaccurate rumors circulating about spectrum refarming.

We support ACT, and we hope the continuing and new council members will be successful in achieving their goals.

We encourage communications technicians to consider joining the association. Information about ACT is available by calling 800-759-0300; ask for "technician services."

—Don Bishop

TRANSCRIPT COMMUNICATION SECURITY...

THERE IS NO EQUAL.

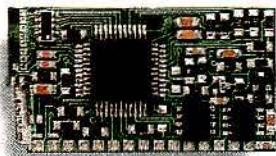
Because communication security is critical, you choose Transcript. When it comes to top performance, versatility, experience and unmatched value, there is no equal to Transcript.

We've been designing innovative communication systems for public agencies for over 15 years. Our communication security equipment has proven itself in over 1000 different radio models in thousands of systems in more than 70 countries. Transcript equipment is the approved standard for law enforcement and government agencies worldwide.

But don't take our word for it. Call anyone with secure communications.

Or call us. We'll give you a list of customers who choose Transcript.

They'll be happy to tell you why.



TRANSCRIPT INTERNATIONAL.

THERE IS NO EQUAL.

CALL 1-800-228-0226.

SENCE AGENCY
U OF NARCOTICS
CITY OF CARLSBAD
TRANSBAY COUNTY PATROL
ROYAL HONG KONG POLICE FORCE
WARNER BROTHERS
U.S. ARMY
DELAWARE STATE POLICE
PLACER COUNTY SHERIFF'S OFFICE
YALE UNIVERSITY
LOS ANGELES POLICE DEPARTMENT
UNITED STATES POLICE SERVICE
OREGON STATE POLICE
CITY OF QUEBEC
LONDON METROPOLITAN POLICE
STATE OF IOWA
SHELL OIL
CALIFORNIA NATIONAL GUARD
HENNEPIN COUNTY SHERIFF'S DEPARTMENT
CANTON REGIONAL TRANSIT AUTHORITY
ARIZONA DEPARTMENT OF PUBLIC SAFETY
FEDERAL BUREAU OF LAND MANAGEMENT
SWEDISH BOARD OF CUSTOMS
FAIRFAX COUNTY PUBLIC SCHOOL SYSTEM
NAVAL AIR WARFARE CENTER
GLOBAL WULFSBERG
CITY OF MONTREAL
YELLOWSTONE NATIONAL PARK
PORTUGUESE CUSTOMS
STATE OF VIRGINIA
POLICE COM

TRANSCRIPT
INTERNATIONAL

THE WORLD LEADER IN VOICE PRIVACY AND SIGNALING TECHNOLOGY

1620 North 20th Street, Lincoln, NE 68503, (402) 435-4400, FAX (402) 435-6780

September

- 21-23—**International Wireless Communications Expo/Fall**, Philadelphia Convention Center, Philadelphia. Contact: 303-220-0600.
28-Oct. 1—**Mobile Communications Marketplace**, New Orleans Convention Center, New Orleans. Contact: Telocator, 800-326-8638.

October

- 18-19—**SMR Management Conference**, sponsored by American Mobile Telecommunications Association, Hyatt Regency Tech Center, Denver. Contact: 202-331-7773.
21-23—**Government Affairs Summit/Fall Meeting**, sponsored by the National Association of Business and Educational Radio (NABER), Ritz-Carlton Hotel, McLean, VA. Contact: 800-759-0300.

November

- 2-4—**WirelessWorld Conference & Exhibition**, sponsored by *Cellular Business* magazine, Buena Vista Palace, Lake Buena Vista, FL. Contact: Chris Lotesto, 800-458-0479.
4-6—**Industrial Telecommunications Association**, La Quinta Hotel, La Quinta, CA. Contact: Barbara J. Levermann, 703-528-5115.
11-14—**Communications Marketing Conference**, Holiday Inn Riverwalk, San Antonio. Contact: Gene Johnson, Vega Signaling, 818-442-0782.
19—**Radio Club of America**, Communications Symposium and Annual Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Ron Formella, 201-652-6811.

1994

February

- 7-8—**AMTEX**, the American Mobile Telecommunications Association's Marketing and Technology Conference and Exposition, Marriott on International Drive, Orlando, FL. Contact: 202-331-7773.

March

- 2-4—**Cellular Telecommunications Industry Association Winter Meeting and Exposition**, San Diego. Contact: 202-785-0081.

- 6-9—**Energy Telecommunications and Electrical Association**, Henry B. Gonzales Convention Center, San Antonio. Contact: 214-235-0655.

April

- 13-15—**International Mobile Communications Expo/Spring**, Las Vegas Convention Center, Las Vegas. Contact: 303-220-0600.

May

- 2-5—**Supercomm**, sponsored by USTA and TIA, and **International Conference on Communications**, sponsored by IEEE, New Orleans. Contact: USTA, 202-835-3100.
12-14—**Mobile Communications Conference**, sponsored by the National Association of Business and Educational Radio (NABER), Peabody Hotel, Orlando, FL. Contact: Nancy Palleschi, 800-759-0300.
25-27—**RadioComm**, Vancouver Convention Center, Vancouver, British Columbia. Contact: Bill Eggertson, 613-233-4888.

June

- 7-11—**Vehicular Technology Conference**, sponsored by IEEE Vehicular Technology Society, Stockholm, Sweden. Contact: Professor Sven-Olof Ohrvik, technical chairman, 46 8 757 0483; Fax 46 8 34 8441.
18-23—**Utilities Telecommunications Council**, Washington Sheraton, Washington, DC. Contact: Rita Clark, 301-621-7802.

July

- 17-20—**Forestry-Conservation Communications Association**, Hershey, PA. Contact: Don Pfohl, 602-644-3166.

August

- 6-11—**International Municipal Signal Association**, Cavanaugh's Inn, Spokane, WA. Contact: Harold Glerum, 800-723-4672.
7-12—**Associated Public-Safety Communications Officers National Conference**, Lawrence Convention Center, Pittsburgh. Contact: 800-824-1850.



Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, *Editorial Director*
Nancy Campbell, *Senior Associate Editor*
Ellen Payne, *Associate Editor*
Kim Bracken, *Free-lance Artist*
Harold Kinley, *CET, Contributing Editor*

INDUSTRY CONSULTANT

Fred M. Link

REGULATORY CONSULTANT

Robert H. Schwaninger Jr., *Brown and Schwaninger, Washington, DC*

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, *President, Omnicom Telecommunications Engineering, Tallahassee, FL*
R. James Evans, *Communications Consultant, East Lansing, MI*
Gary David Gray, P.E., *Chief Telecommunications Engineer, Orange County Communications, Orange, CA*
Frederick G. Griffin, P.E., *President, Frederick G. Griffin P.C., Lynchburg, VA*
Mary Kjørvestad, *Empire Mobile Communications, Houston*

Larry Kline, *Beachwood, OH*
S.R. McConoughey, P.E., *Mobile Communications Consulting, Gaithersburg, MD*
Art McDole, *Salinas, CA*
Stuart F. Meyer, *Land Mobile Consultant, Vienna, VA*
Herb Sachs, *Herb Sachs Consulting, Bowie, MD*
Leon Spencer, *Radio Engineering Systems, Exxon Company USA, Houston*
Dr. Gregory M. Stone, *Senior Associate, Booz, Allen & Hamilton, McLean, VA*
Raymond C. Trott, P.E., *President, Raymond C. Trott Consulting Engineers, Irving, TX*
William A. Wickline, P.E., *Mentor, OH*

CORRESPONDENCE: Editorial and advertising correspondence should be addressed to P.O. Box 12901, Overland Park, KS 66282-2901, 913-341-1300, fax: 913-967-1904.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' reps, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are re-

sponsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; in Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription. Send subscription information to: P.O. Box 12968, Overland Park, KS 66282-2968.

PHOTOCOPY RIGHTS: Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Intertec Publishing, provided that the base fee of US \$2.00 per copy, plus US \$00.00 per page is paid directly to Copyright Clearance Center, 27 Congress Street, SALEM, MA 01970, USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transaction Reporting Service is 0745-7626/1993 \$2.00 + \$00.00.

BPA

ABP

\$3.00 + 0.00

Audited circulation.

INTERTEC PUBLISHING

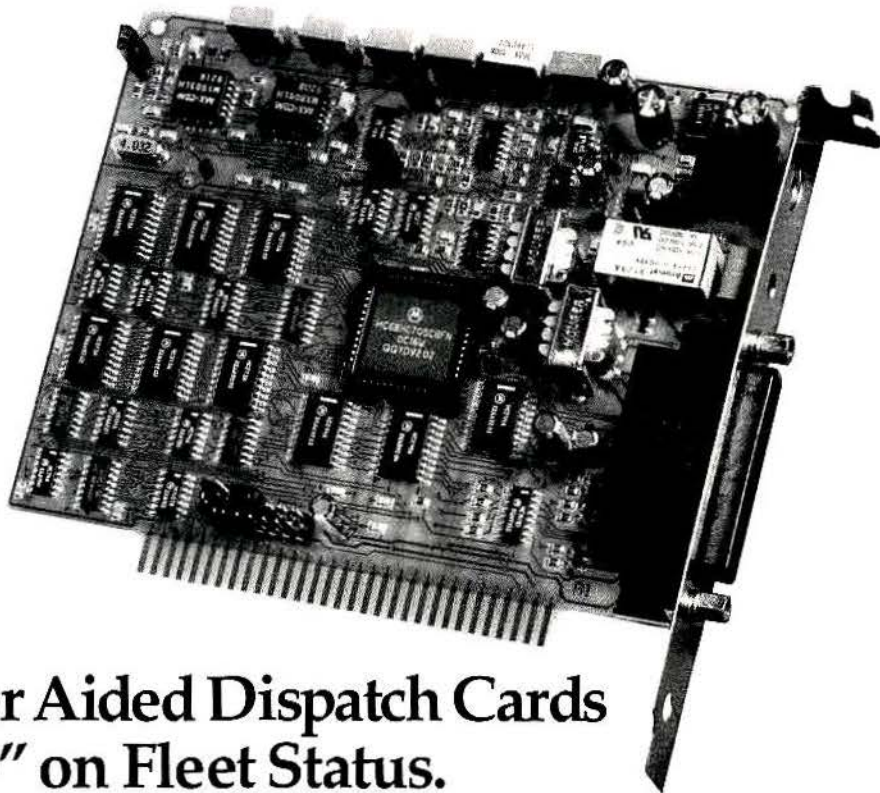
© 1993 by Intertec Publishing. All rights reserved.

STATUS SYMBOLS

MX P25 CADi SelCall
N-Tone Encoder/Decoder
(38mm X 23mm)



MX P10 CADi Computer Card:
N-Tone Encoder/Decoder



CADi™ Computer Aided Dispatch Cards "Close the Loop" on Fleet Status.

Radio fleet managers need not rely on verbal responses or mobile initiated status reports. The CADi™ System provides fast, non-verbal unit identity (ANI) and reporting of fleet unit status. Reception of both inbound and outbound messages is confirmed. Worker safety is assured. A personal computer equipped with an MX P10 N-Tone Encoder/Decoder closes the communication loop to radios equipped with MX P25's or to any other SelCall units. The CADi™ System selectively calls fleet units, retrieves status reports and acknowledges mobile originated traffic.

**To raise your fleet's dispatch status,
Call Toll Free: 1-800-638-5577**

MX • COM, INC.

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054

Circle (7) on Fast Fact Card

Transmitter noise

By Harold Kinley, CET

Transmitter sideband noise is a problem that must be taken into account when operating a receiver and transmitter in close proximity and at close frequency spacings.

The best way to describe transmitter noise solutions is to look at examples. The following examples and illustrations should help you to understand how to calculate the isolation (signal attenuation) required to keep transmitter noise from degrading the radio signal reception at nearby receivers.

In Figure 1A below, the transmitter operates at 159.345MHz and the receiver at 159.120MHz. Both antennas are 6dB-gain omni-directional units composed of four stacked folded dipoles.

The transmitter power is 100W (50dBm), and the receiver sensitivity

is $0.35\mu\text{V}$ (-116dBm) at 12dB SINAD. To prevent the transmitter noise from interfering with signal reception at 159.120MHz, noise coming from the transmitter on 159.120MHz must be attenuated to a level below the receiver sensitivity or below -116dBm .

Usually, to minimize received signal degradation, transmitter noise is attenuated at least 10dB below the receiver's sensitivity. In this case, the transmitter noise would have to be suppressed to a level of -126dBm .

How much attenuation or isolation is required?

First, you must know the level of the transmitter noise at the particular frequency of interest.

The best way to determine this is to refer to the manufacturer's data sheet or graph of transmitter noise level vs. frequency. Manufacturers should be able to supply this information on request.

If you do not have the data sheet or graph, the situation is not hopeless. FCC rules and regulations establish minimum standards that all transmitters must meet.

According to FCC requirements, transmitter noise at 159.120MHz (from

the 159.345MHz transmitter) must be down at least $43 + 10\log(P)$ decibels below the carrier level (dBc) or 80dB, whichever is the lesser attenuation.

Transmitter carrier power is 100W. Substituting into the formula:

$$\begin{aligned}\text{Attenuation (dB)} \\ &= 43 + 10\log(100) \\ &= 43 + 10(2) \\ &= 43 + 20 \\ &= 63\text{dB}\end{aligned}$$

Because 63dB is less attenuation than 80dB, 63dB is the attenuation figure to be used, which means that the transmitter noise at 159.120MHz should be down 63dB from the carrier power level.

Because the carrier power level is 100W or 50dBm, the transmitter noise level must be no more than 50dBm $- 63\text{dBm} = -13\text{dBm}$ at the transmitter output.

Loss in the transmission line and any filters, duplexer, isolator and other passive equipment must be taken into account. Let's say that no filters or duplexers are used at first, and that the line loss is 2dB.

Next, the isolation or signal attenuation between the transmitting and receiving antennas must be determined.

Figure 2 on page 56 can be used to approximate the isolation between the antennas. Figure 2A is for vertically separated antennas. Figure 2B is for horizontally separated antennas.

For a horizontal separation of 200 feet, the graph (150MHz) shows attenuation to be approximately 50dB. Remember, though, that for horizontal separations, the sum of the gains of the two antennas must be deducted from the isolation figure on the graph.

Because both antennas have 6dB gain, 12dB must be deducted from the figure on the graph: $50\text{dB} - 12\text{dB} = 38\text{dB}$. Thus, the isolation between the antennas in Figure 1A is 38dB.

On the receiver side, again, the line

(continued on page 56)

Kinley is a certified electronics technician with the South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, Prentice-Hall, 1985.

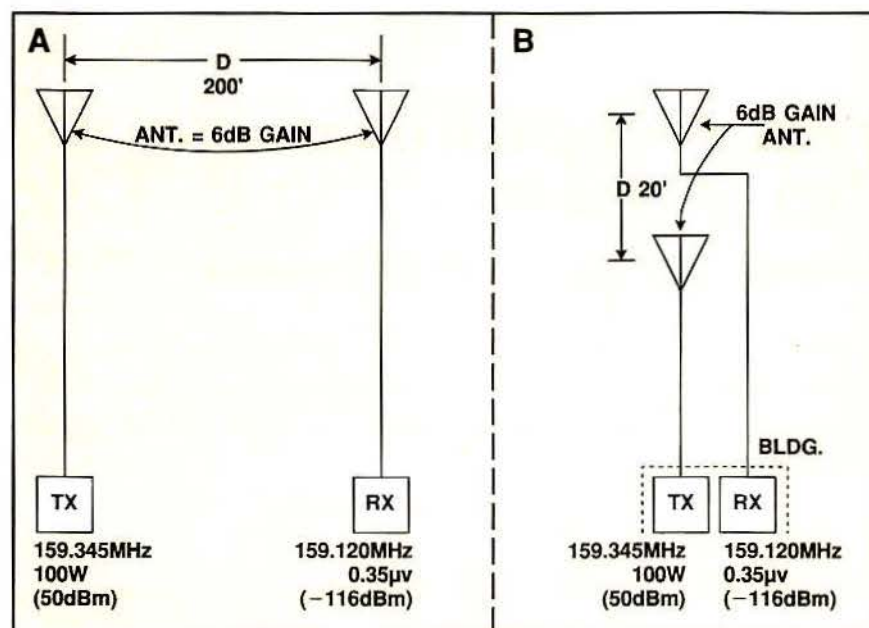


Figure 1. At (A), the antennas are separated horizontally (equipment in different buildings). At (B), the antennas are separated vertically with equipment in same building and antennas located on same tower. In this example, the 20 feet of vertical spacing between the antennas provides much better isolation than the 200 feet of horizontal spacing.

Save Your Batteries For When You Really Need Them.

Use X-Tra Talk[™], from Centurion.



Now you can make sure your batteries are ready when you need them.

It's simple. When operating from your vehicle, make it standard procedure to power

your two-way portable with X-Tra Talk (patent pending), the battery eliminator from Centurion.

X-Tra Talk plugs into your vehicle's lighter (or any other 12-volt source) to give you hassle-free operation for as long as you need to talk. No worries about power drain. No problems with related weakening of signal.

And best of all, no surprise battery failure down the line when you really need to use them.

Because X-Tra Talk gives you: • Maximum power output from your radio • Extended battery life • Protection against reverse polarity and current surges • Compatibility with virtually all popular two-way portables.

So why drain your radio's battery when you can tap into your vehicle's power source? Get X-Tra Talk and eliminate the frustration of batteries failing when you need them most.

X-Tra Talk. Another bright idea from Centurion, your two-way portable power source.

Call us toll-free at 800-228-4563 for the name of our distributor nearest you. And ask about our full line of batteries and power packs.



CENTURION INTERNATIONAL, INC.
Power When You Need It.

Site safety: Planning for success

Identify safety hazards, write safety rules and train workers how to eliminate or mitigate the risks posed by the safety hazards. A good safety plan protects workers and equipment, and reduces potential liabilities.

By Donald E. Koehler

Site safety begins with a comprehensive written safety plan. To write a successful plan, include at least these four parts:

► **Involvement and commitment**—Develop a policy statement that outlines the minimum responsibilities of workers, supervisors and managers.

Establish priorities and, when appropriate, deadlines. Assign accountability for managers and workers.

In addition, the statement can include goals for safety and health.

► **Hazard identification and controls**—Describe site hazards that are or may be present.

Provide for an initial hazard survey and intervals for follow-up inspections or surveys. Outline a method or procedure for workers to report hazards.

Describe how to keep records of identified hazards, when they were reported and the corrective measures taken to eliminate or mitigate them. Some states require such record-keeping and have further requirements. Check with your state's occupational safety and health service.

As part of the assessment and control process, the plan should define procedures for accident or mishap reporting and investigation. The procedures must identify accident causes and recommend corrective actions.

Koehler is a technical writer, technical resource researcher, and computer, communications and database specialist for Hartec Management Consultants, Anchorage, AK.

The procedures should outline actions to prevent similar accidents.

Specify a monitoring procedure to track work-related illness and injuries. Such monitoring helps to involve managers in the safety program.

Identify how personal protective equipment (PPE) and specific produc-

tion equipment should be used.

when new or upgraded systems are installed. Scrutinize the equipment design, installation, engineering and planned maintenance for known or possible hazards to workers.

Safety rules should cover general principles, such as no horseplay on the job site, and specific operations.

Operation-specific safety rules may cover battery bank testing, generator set refueling and how to maintain the grounding system while the site is powered and operating. Post these rules in a prominent location at the shop and on the site as a reminder. Include in the orientation procedure for new employees a review of the rules, and obtain from new employees a signed statement confirming that they have read the rules and that they understand them.

Standard work practices or procedures are important when several workers perform maintenance at an equipment site.

Develop the procedures with worker participation. Ask a safety professional who is familiar with electronic maintenance practices to review them.

As with any maintenance effort, these rules and procedures must be part of the organization's training program. Enforcing the rules with a fair and understandable disciplinary policy is part of a management process to ensure standard work rules and procedures protect all workers.

► **Occupational safety health and training**—All new workers should be trained regarding site-specific hazards known or presumed to exist.

Safety plan elements

- ☐ **Expressed management involvement and commitment.**
- ☐ **Hazard identification and controls.**
- ☐ **Planning and setting safety rules and standardized work rules.**
- ☐ **Occupational safety and health training.**

tion equipment should be used.

For example, when to use gloves and when/how to shore a trench can be included directly in the plan. Alternatively, they can be included by reference to appendices or to site-specific, supplemental safety plans.

Safety equipment required on the job may be purchased by the company or by the workers, who are given an allowance to offset the expense. In either case, define proper safety equipment use. Write a statement that reinforces the general policy statement, and describe disciplinary action that may be taken if the required safety equipment is not used according to the plan.

► **Planning and rules**—Planning starts when equipment is specified or

CONVENTIONAL RADIOS.

High Performance Sound Systems assure crisp, clear communications even in the worst conditions.

Backlit controls with bright, easy-to-read LED displays make the IMU/IMH mobile radios ideal for night use.

Die-Cast Metal Chassis & Mil Spec Rating for day-in, day-out use in the most demanding applications.

Wideband coverage allows one radio to be used for many applications.



UNCONVENTIONAL FEATURES.

Uniden's IMU/IMH 99-channel mobile radios are setting the pace out on the road.

First we brought intelligence to trunked radios. Now for some conventional wisdom.

Our IMU/IMH wide band radios are designed for day-in, day-out use in the most demanding applications. Their 99 channel capacity and priority scan ensure you won't miss an important dispatch. And they operate on 40 watts VHF and 30 watts UHF, for maximum performance.

Wide-band operation makes it possible to cover the entire VHF and UHF band without degra-

dation. And a touch of a button gives you instant Talk-Around capability for ease of use.

Plus, you'll enjoy the first-class ergonomics Uniden is famous for. Like backlit controls for night use, and easy-to-read LED displays.

All of which make our IMU/IMH conventional radios anything but conventional.

For more information on IMU/IMH radios, please call us toll free at (800) 235-3874, extension 3639 today.

uniden
Quality Goes the Distance

A written plan helps to ensure all hazards, safety rules, standard work procedures, company policies and proper use of required PPE are explained to the new worker.

Include a tear-out sheet for the worker to sign when each training step is completed. File these sheets as references to indicate when refresher training is due.

When new equipment is installed, when a new work site is included in the business, or when equipment has been modified, review the safety plan.

After an accident or near-accident happens, or when new information is learned that affects worker safety, a refresher training session may be required. Document the session as you would for all other training.

The effort expended to write a safety program and train workers is returned by lower worker injury rates, reduced turnover and reduced equipment damage or loss.

A formal safety and health program may be required by state and federal law. Check with the state occupational safety and health office to find out the possible requirements.

Having a formal safety program may allow you to negotiate lower insurance rates.

The effort spent to develop a safety program is worth the time and money in reduced injury and improved worker morale.

Some of a site-specific plan's features that may be required under Title 29 of the Code of Federal Regulations (29CFR) or other Occupational Safety and Health Administration (OSHA) rules are included in the following example. This example is not intended for any use other than educational.

Table of Contents

1. General safety policy statement.
2. Safety rules, shop and remote site.
3. Work site hazard information.
4. Housekeeping and sanitation.
5. Fire prevention.
6. Electrical safety.
7. RF safety.
8. Grounding safety and maintenance.
9. Battery bank and charger safety.
10. Personal protective equipment.
11. First-aid and evacuation procedures.
12. Accident reporting.
13. Proper lifting techniques.
14. Climbing equipment and safety.
15. Education and training, HAZCOM.

The site-specific safety and health plan requires a lot of thought and research. It can, and should be, the safety program's foundation.

The safety program should give the worker, in simple and understandable terms, the information needed to perform the job safely. The site-specific plan should give workers a process for informing managers of hazards and a detailed accident-reporting procedure. It should explain how to mitigate hazards that cannot be eliminated.

Once completed, the safety program should be reviewed by a professional.

Another information source is other local maintenance organizations' safety plans. Expect to pay for other

LIKE NOAH'S ARK, EVERYTHING YOU NEED UNDER ONE ROOF.



Direct factory wholesale prices

Most items shipped from inventory within 24 hours

Design and supply of customized telecommunication networks and automatic vehicle location systems



MOTOROLA

MIDLAND
LAND MOBILE RADIO

Radius
A DIVISION OF MOTOROLA

ANDREW

BIRD



NEWMAR



CELWAVE
DIVISION OF RADIO FREQUENCY SYSTEMS



Microwave Networks
INCORPORATED

ZETRON

BARRETT
COMMUNICATIONS



SINCLAIR

FacilityTech
Systems International

CES



Marketronics
CORPORATION

One of the World's Leading Distributors
of Quality Telecommunications Equipment

INTERNATIONAL: (305) 846-1011

USA: (800) 845-1230 FAX: (305) 846-1672

320 INTERNATIONAL PARKWAY SUNRISE, FLORIDA U.S.A. 33325



Circle (10) on Fast Fact Card

INTRODUCING...

CTCSS Trak™



CTCSS Trak™ is a breakthrough CTCSS decoding technology that gives our TP-154 the hottest CTCSS sensitivity and fastest decoding speed of any repeater tone panel in the business!

CTCSS Trak™ holds on tenaciously and does not talk down or false during the grueling industry standard FFFOOUUURRR test. Yet when a mobile unkeys **CTCSS Trak™** immediately closes the repeater squelch so unwanted background chatter is not heard in the mobile.

CTCSS Trak™ is now standard in every TP-154 and delivers a level of repeater performance that must be experienced to be believed.

CTCSS Trak™ firmware can be added to your existing TP-154's for only \$35.00 ea.

STANDARD FEATURES

- 50 CTCSS Tones
- 104 DCS Codes
- Supports 154 Subscribers
- Local and Remotely DTMF programmable
- DTMF-DTMF Regeneration
- Front Panel Display for Programming and DCS/CTCSS indication
- COS Input with polarity select
- Low Power Mode for solar powered sites
- Transponds all programming data to a CD-1 for programming verification
- E Trunk Compatible

PER USER PROGRAMMABLE FEATURES

- Hangtime
- Cross Tone and Code
- CW ID
- Courtesy beep
- Barge-in
- User Enable/Disable
- Reserve Tone
- Hog Penalty
- DCS/CTCSS during hangtime

SYSTEM PROGRAMMABLE FEATURES

- Programming Mode Access Code
- Activity Timer
- Kerchunking Filter Enable/Disable
- DCS Input Polarity
- DCS Output Polarity
- Repeater CW ID
- ID Speed
- COR or DCS/CTCSS Operate

CD-1 COMMUNICATIONS DECODER



The **CD-1** is a remote programming display for your TP-154. Every time you send up a command the TP-154 transponds the result to your **CD-1** display. Makes remote Programming as easy and positive as local programming.

The **CD-1** also decodes and displays 50 CTCSS tones, 104 DCS codes and DTMF when connected to your scanner or service monitor de-mod output. Useful for system monitoring and service work when not being used for remote programming.

Only **\$199**

- 60 Day return privilege • One year warranty



Connect Systems Inc.
2259 Portola Rd.
Ventura, CA. 93003

Toll free

(800) 545-1349

Phone (805) 642-7184

FAX (805) 642-7271

Call today to find out more about **CTCSS Trak™** and other product improvements. The TP-154 is still unbelievably priced at only... **\$299**

organizations' information because the reuse of most safety plans prepared by professionals and consultants is protected by copyright or other restrictions.

Some sample chapters follow.

Safety policy statement:

The management of (your company or agency) recognizes the need for a safe and healthy work place.

Managers and workers share the work place safety responsibility.

The management accepts responsibility to identify work place hazards and to mitigate the hazards through physical protection, personal protective equipment and information that allow workers to understand and avoid hazard exposure.

The workers are responsible to fol-


low all work rules, train for and use standard work practices, use personal protective equipment and report hazards and accidents.

Failure to follow safety rules and standard work practices may be grounds for termination of employment.

Work site hazard information:

Place a copy of checklists and explanations of terms at the front or at the end of the chapter.

1. Physical hazards.
 - A. Electrical.
 - B. Chemical.
 - C. Noise.
 2. Hand and power tool use.
 3. Ladders and scaffolds.
 4. Driving policy.
 5. Battery bank testing procedures.
 6. Generator changeover procedures.
 7. Generator refueling procedures.
- Although these two sample chapters



CHECKMATE IV
THE NEXT GENERATION

Providing Tone and Voice Pages for over twenty years.

FEATURES:

- Choice of Reed or Programmable Decoder
- Reed - High Sensitivity
- Programmable - Increased Option Features
- Rugged Black or Red Case
- Small Size - 3 1/8" x 2 7/16" x 1 5/16"
- Single "AA" Battery
- Variable Volume Control
- Group Call Standard on Second Tone
- Channel Monitoring Capability
- 3 Year Limited Warranty Standard
- 4 & 5 Year Limited Warranty Available

SHINWA Communications of America Inc.
P.O. Box 26407
Oklahoma City, OK 73126
TEL 1-800-627-4722
FAX 1-800-759-1722

SHINWA Tsushinki Co., Ltd.
12-2 Hamadayama 4-Chome
Suginami-Ku Tokyo, Japan
TEL (03) 3313-1211
FAX (03) 3313-1218
TELEX: J27432 Slnwacom

Advice for multi-user site operators

Multi-user site operators should obtain copies of all users' safety plans.

Review these plans for conflicts with internal safety plans. (It is not normally the site operator's prerogative to approve or disapprove a user's safety plan.)

When conflicts are noted or when a user has no safety plan, review the contract with the user for possible liabilities.

Post site-specific safety plans and rules in plain view at each site.

At sites with battery banks or other hazardous equipment that requires personal protective equipment (PPE), post a copy of the specific work procedures for that equipment and list the PPE required.

Post a checklist or inventory of PPE, including first-aid kits, kept on the site.

Post a list of emergency telephone numbers or radio communications frequencies, and keep it up to date.

Circle (12) on Fast Fact Card

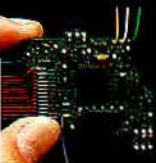
CES

**TRUNK YOUR
COMMUNITY REPEATERS WITH ...**

LANCER

**TRUNK YOUR
CONVENTIONAL
RADIO EQUIPMENT
WITH AFFORDABLE,
FEATURE-RICH
LANCER NETWORK
SYSTEMS.**

When you are ready to add advanced trunking technology to your conventional radio systems, isn't it nice to know that the technology is ready for you?



The Local Area Network Central Exchange Radio network provides many of the features found in trunked radio systems and cellular telephone service. Now you can easily "trunk" your existing radios, both mobile and handheld, already in service. A LANCERnet terminal on each repeater and a LINC module in each portable or mobile radio are

the only requirements for setting up your LANCERnet system. Call or FAX us today for complete information on the powerful LANCERnet system.



- Automatic Channel Allocation
- Intersystem Security & Privacy
- Validate Users by Tone, ANI, or Both
- Up to 2,000 Users Per Channel
- Conference and Group Calling
- Two Tone Paging
- Talk Back Paging
- Multi-level Priority User Override
- Full Remote System Control
- On Board Call Accounting
- Direct Inward Dialing Option
- Remote Delinquent Subscriber Disable & Enable
- Out of Range Conventional Operation



**Communications
Electronics
Specialties, Inc.**
931-218 South Semoran Blvd.
Winter Park, Florida 32792 USA
Telephone: (407) 679-9440
Toll Free: 1-800-327-9956
FAX: (407) 679-8110
Circle (13) on Fast Fact Card

CES

Common questions during a safety plan review

(1) Have you given local emergency and law enforcement officials a current, readable map to all of your sites?

(2) Are required safety items, such as first-aid kits, eyewash fountains, gloves and face shields, available?

(3) If technicians are dispatched alone to remote sites, does your plan have a procedure for check-

ing their status periodically?

(4) Do interlocks on multi-user sites send an alarm to a monitor and remove power when they are opened?

(5) Have you posted safety plans at all of the sites under your control?

(6) Is the emergency contact list current?

understand the information.

The safety plan document should have a hazard communication (HAZCOM) appendix with any required material safety data sheets. Most small radio repair companies or user-operated repair centers do not handle enough hazardous chemicals to warrant a full HAZCOM program; nevertheless, check with the local occupational safety and health organization office to ensure the plan complies with the law. This office may be listed as a Department of Labor office.

The simplified sample format allows for changes in procedures, methods and work standards. Small business and small agency managers should be able to write an acceptable safety plan. Still, it should be reviewed by a safety professional or a state agency charged with worker safety.

Involving workers and management in preparing and carrying out the plan helps to ensure success.

are by no means as complex and detailed as an actual site-specific health and safety plan, they show some of the subjects and a usable format.

By placing the procedures at the end of each appropriate chapter, changes caused by new equipment or methods can be made easily with little effect on

the rest of the safety plan. A copy of the procedures should be posted next to equipment to remind workers.

When multiple sites are covered by a single plan, use fill-in-the-blank style documents. They cost less, and they are easier to change. Almost any format works, as long as the workers can



If you've been looking for a low-cost desktop console with large-system features...

Look at the ULTRA-COM 96DT Desktop Radio Control Console

9-1-1 Compatible - with the exclusive Programming Help Menus that let you adapt your system to your requirements



The ULTRA-COM 96DT represents a unique application of console design and microprocessor technology to meet the needs of 4- to 16-channel users, with large-console features at "desktop" cost. Its application of microprocessor technology and ergonomic console design provides all the features found in larger, more expensive systems.

Write for detailed literature and specifications.

MODULAR COMMUNICATION SYSTEMS, INC.

13309 Saticoy St., No. Hollywood, CA 91605 / (818) 764-1333 / FAX (818) 764-1992

Circle (25) on Fast Fact Card



The new R-2550.
COMMUNICATIONS SYSTEM ANALYZER

**At only \$8695,
it produces like a money tree.**

In today's economy, your shop needs maximum value – top performance at lower cost.

Motorola introduces the R-2550, with the combination of performance features you need – variable level duplex generator

- auto calibrated spectrum analyzer • auto calibrated field strength meter • large (7" diagonal) CRT • digital storage oscilloscope • dozens of additional features – all at a price that will make you think you planted a money tree.

For information, call:

1-800-235-9590

Or write P.O. Box 2606
Scottsdale, AZ 85252



MOTOROLA

Quality means the world to us.™

© Copyright 1993 Motorola Inc. ® and Motorola are trademarks of Motorola Inc.
\$8695 is the U.S. domestic price.

Circle (15) on Fast Fact Card

Behind the FCC label on a land mobile radio

Plenty of tests and paperwork must be completed before the FCC label is placed on a land mobile radio. Here are the procedures that must be followed before radio equipment reaches the marketplace.

By Rex E. Miller

Transmitters, receivers and transceivers operating in the land mobile radio frequency bands all have one thing in common: an "FCC" label permanently affixed to the device.

Most radio dealers and users know that this label is the FCC's "stamp of approval," but few know the technical process required to obtain the right to affix the label to a land mobile radio.

Label

Information on the label may consist of the *grantee's* name, which may identify the manufacturer, organization, individual or importer that provided technical data to the FCC demonstrating that the radio complies with the agency's technical standards.

The grantee is responsible for the radio's compliance with FCC rules and is the holder of the *Grant of Equipment Authorization* the FCC issues. The grant lists the grantee's name; FCC Device Identification Number, the FCC rule part(s) under which the radio is allowed to operate; equipment class; frequency range; power output; frequency stability and emission designator(s). The label's

When this article was written, Miller was a contract engineer with Waseca Technology, Waseca, MN.

Waseca Technology was acquired by ADC Kentrox, Portland, OR, in June 1993 and continues to operate as the Development Center of ADC Kentrox in Waseca.

Miller now is president of an EMI consulting company, TWS Consultants, in Waseca, MN; telephone 507-835-5749.

most important information is the *FCC Identifier* required by the commission's rules.

The identifier consists of a grantee code assigned by the FCC and a product code assigned by the grantee.

A grantee code consists of Arabic numerals, capital letters or a combination. Once a grantee code is assigned, the grantee continues to use it for subsequent equipment authorization applications.

The product code selected by the

The grantee applicant or assigned agent makes measurements to verify that the equipment complies with appropriate technical standards.

grantee consists of Arabic numerals, capital letters or a combination, and may include a dash or hyphen. The number of numerals, letters, dashes and hyphens may not exceed 14, not including the 3-character grantee code. The product code is unique to the radio and cannot be used with another device associated with the same grantee code.

Additional information must precede the grantee and product codes. The term *FCC ID* must precede the grantee

code and product code. The term *FCC ID* must precede the identifier code. For a transceiver with a receiver subject to the verification process, which is typical of a land mobile transceiver, the term *FCC ID* precedes the FCC identifier required for the transmitter portion of the transceiver.

Example:

FCC ID XXX 0000
└──────────┘
 Product code
└──────────┘
 Grantee code

A label for a stand-alone receiver must also include a statement pursuant to Part 15.19 of the FCC rules.

Separate FCC identifiers may be assigned to a device consisting of two or more sections assembled in a common enclosure. The FCC ID assigned to a transmitter section is preceded by the term *TX FCC ID*. The receiver section is preceded by the term *RX FCC ID*.

Refer to FCC Rule Part 2.925 for additional information.

Authorization procedures

There are several procedures available for equipment authorization depending upon the type of radio.

► *Verification*—The most common procedure used with a transceiver's receiver portion is the verification procedure.

The grantee applicant or assigned agent makes measurements to verify that the equipment complies with appropriate technical standards. No forms or technical data are filed with

Take A Look At Our Brass

After a Cushcraft/Signals antenna has been installed, you won't see the UltraLink Cable,TM the all-brass mount or the silver-plated contacts. Quite simply, you won't see some of our best work.

With UltraLink Cable, installs are fast and easy. It snakes great and the connectors fit right. The Teflon[®] core makes it the best cable for high temperature applications. Its low-loss characteristics will allow more of the signal to reach the antenna. Our all-brass mount won't corrode so it's easy to remove. Larger teeth and a soldered lug insure an excellent ground.

When the world's largest package delivery company needed antennas for their parcel tracking system, they chose the one you see here. Make the informed move to Cushcraft/Signals for all your demanding mobile applications.

Call us or your favorite distributor for your mobile and base antenna needs.

UltraLink CableTM



- Low-loss Teflon[®] dielectric
- Withstands high temperature
- Fits standard RG58 size connectors
- Easily removed dual shields
- Solid center conductor

All-Brass Mount

- Non-corroding
- Parts won't seize together
- Large grounding teeth
- Soldered ground lug

Cushcraft/Signals
supplies a complete line
of base and mobile antennas.

1-800-258-3860
FAX: 1-800-258-3868

cushcraft/Signals

FCC testing

The following information applies to equipment authorization testing for a typical land mobile FM transceiver.

Transmitter testing is done in accordance with FCC Part 2 and Part 90 rules using the type acceptance procedure. Receiver testing is done according to FCC Part 15 rules under *unintentional radiators* using the verification procedure.

► **Transmitter type acceptance**—A typical FCC type acceptance test report for a land mobile FM transmitter consists of the following technical tests:

(1) **Transmitter rated power output.** Both the dc power input and the RF power output of the final amplifier stage are measured.

(2) **Frequency response of transmitter audio modulating circuit.** This is a test of the overall transmitter audio modulation characteristics measured over the audio input range of 100Hz to 10,000Hz.

(3) **Audio response of audio filter.** This is a test of the transmitter's audio lowpass filter

by itself without the influence of other circuits. The response requirements change depending on the operating RF band as specified in FCC Part 2 and Part 90 rules.

(4) **Percentage of modulation vs. input voltage.** Modulation input level and frequency are varied in a series of tests to determine whether there is a combination that may cause overmodulation.

(5) **Transmitter spurious and harmonic outputs.** All transmitter unwanted harmonics and spurious signals are measured at the antenna output connector over a frequency spectrum equal to 10 times the carrier output frequency.

(6) **Transmitter occupied bandwidth.** This test measures out-of-band emissions occurring on a frequency or frequencies immediately outside the necessary transmission information bandwidth. This test must be repeated for each emission designator applied for on the equipment authorization application.

(7) **Frequency stability with variation in ambient temperature.** The RF carrier's frequency is measured in 10°C increments from -30°C to +50°C.

(8) **Frequency stability with variation in supply voltage.** The RF carrier's frequency is measured while varying the main power supply voltage $\pm 15\%$ of nominal.

(9) **Spurious radiation attenuation.** This is a measurement of unwanted signals radiated from the transmitter through the air. Testing normally is conducted on an outdoor calibrated test range using calibrated antennas and test equipment.

(10) **Additional information.** The test report should provide a circuit description, schematics, photos, FCC ID label artwork, operating manual, transmitter tune-up procedure and qualifications of the engineers who perform the tests. It should explain the functions of all active devices. The test report is filed with the FCC along with an application form, a filing fee and a filing fee form.

► **Receiver verification**—A verification test report is not filed with the FCC. Instead, it is kept in the grantee's possession.

A typical verification test report for the receiver portion of a land mobile transceiver consists of the following technical tests pursuant

to FCC Part 15 rules.

(1) **Antenna power conduction.** This is a test of conducted unwanted spurious signals that appear at the receiver's antenna terminal.

(2) **Radiated emissions.** These are unwanted signals radiated from the receiver through the air.

Using calibrated antennas, this test is performed on an FCC-approved test site. The range of radio spectrum searched depends on the radio frequency signals the receiver generates.

(3) **Report.** A report should be compiled that contains the technical test data, schematics, operating manual, circuit description and circuit block diagrams and retained by the grantee to show that the receiver complies with FCC rules.

(4) **Spurious signals.** If the receiver is powered from the public utility ac power lines, a measurement of spurious RF signals that the device conducts back into the ac lines must be made using specified *line impedance stabilization networks*.

Visit us at IWCE, Booth #316.

Our new broadband panel of experts.

They're experts at versatility. Experts at reducing interference. They cover such a wide range, it takes fewer of them to accomplish just as much.

Perfect for any application: SMR, Cellular, Paging, even PCN, Celwave's new broadband line of panel antennas are available in 60°, 80°, 90°, 105° and 120° sector versions. Their profiles are slim, they're aesthetically pleasing, strip line fed, have no soldered joints and are made of irradiated aluminum. Radiating elements

and feed point are protected from the weather by an environment-proof, ABS Radome.

When it comes to improving your system's performance, don't trust anyone but a Celwave expert.

CELWAVE®

DIVISION OF RADIO FREQUENCY SYSTEMS INC.

Celwave, Route 79, Marlboro, NJ 07746

(908) 462-1880 (800) 321-4700

the FCC, although a test report should be compiled and kept on file by the grantee.

► **Type approval**—Type approval is an equipment authorization based on equipment measurements made at the FCC laboratory for a fee.

► **Notification**—The notification procedure requires the applicant or assigned agent to make measurements to determine whether the equipment complies with appropriate technical standards.

An appropriate form is filed with the FCC, and the agency may want a copy of the FCC label ID and equipment photos.

Notification is the most common procedure used to apply for Part 15 authorization for a land mobile stand-alone receiver. A filing fee is required along with a filing fee form.

► **Type acceptance**—To use the type acceptance procedure, the grantee applicant or assigned agent performs prescribed tests, compiles a test report and submits the test report and an FCC

form to the commission for review.

Type acceptance is the most common procedure for applying for Part 2 and Part 90 authorization for a stand-alone transmitter or the transmitter portion of a transceiver. A filing fee is required along with a filing fee form.

► **Certification**—Certification procedures apply to equipment authorization for devices designed to be operated without an individual license under FCC Part 15 rules.

The grantee applicant or assigned agent submits required test data along with appropriate forms to the FCC for review. This procedure is used to gain equipment authorization for low-power transmitters referred to as *intentional radiators*, which cover conventional transmitters and spread-spectrum devices. A filing fee is required along with a filing fee form.

Data transmission

Often, land mobile radios are used to send and receive data instead of voice or tones.

Some situations require that the transmitter's internal modulation control circuits be bypassed and an external modem or data generator be connected directly to the point in the radio where the RF carrier is modulated. The modulation control circuits thus are located in the modem-data generator.

When connecting this external device to a land mobile radio, modification of the radio's Type Acceptance Equipment Authorization is required, and additional test data must be submitted to the FCC.

Conclusions

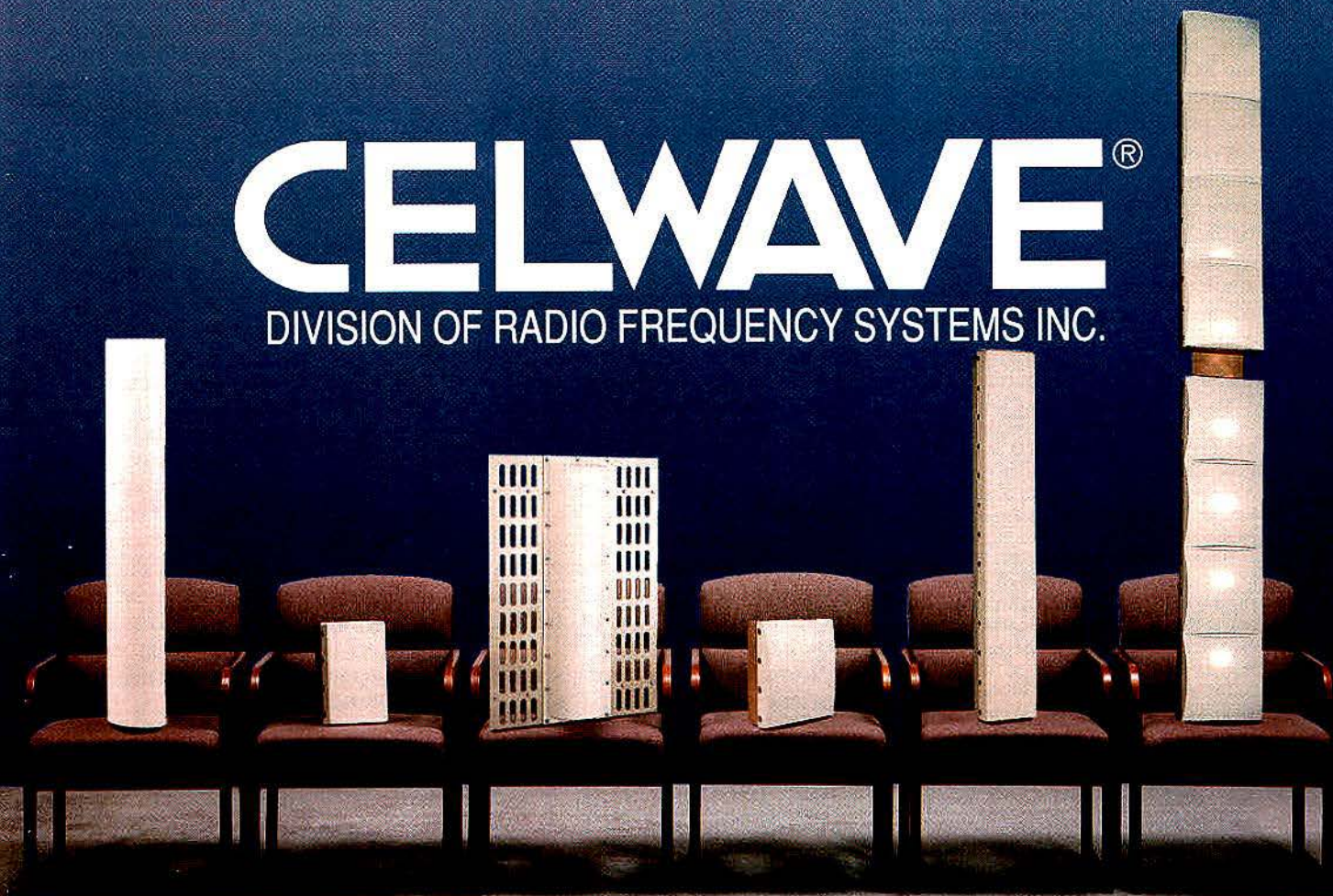
FCC compliance testing for equipment authorization is a complex matter.

Calibrated test equipment and test sites are required, along with highly trained specialists. The FCC Identification Label attached to the land mobile radio may be small, but the technical testing, test report and associated paperwork behind it add up to a big item.



CELWAVE®

DIVISION OF RADIO FREQUENCY SYSTEMS INC.



Narrowband channel signaling demands bandwidth efficiency

Contrary to popular belief, reducing channel spacing and transmitter power as the FCC proposes to do in its spectrum refarming project will not increase spectrum efficiency. The technical reasons are many.

By Dr. Gregory M. Stone
and Karen Bluitt

Considering the tremendous worldwide pressures placed upon radio spectrum as a natural resource, the introduction of adaptive communications philosophies such as that embodied by Motorola's Astro digital technology represents the dawn of a new era in personal communications.

Bandwidth- and spectrum-efficient technologies and architectures are soon to be mandated by the FCC for state and local government and business licensees in the private land mobile radio services in the agency's far-reaching spectrum refarming *Notice of Proposed Rulemaking* (NPRM) in PR Docket 92-235 and for federal agencies through similar efforts by the National Telecommunications and Information Administration (NTIA).

Stone is a senior associate with the professional services firm of Booz-Allen & Hamilton, McLean, VA. He holds a Ph.D. in electrical engineering; he is a Fellow in the Radio Club of America; and he is chairman of the IEEE Vehicular Technology Society's Propagation Committee.

Bluitt is a principal engineer with Sparta, a high-technology research and development company. She holds a B.S. in computer science and an MBA in management science. She is a member of the IEEE, ACM and Society of Women Engineers.

The opinions expressed in this article are solely those of the authors and do not necessarily represent those of their employers or other staff members.

Similarly, the deployment of digital cellular telephone, digital personal communications services (PCS) and wireless local area networks will be based upon the exploitation of such advanced technologies.

Moreover, the standards-setting pro-

multimedia digital technologies. Spectrum refarming and Project 25 will have a profound effect upon the features and limitations of digital technology that reaches the field.

Worldwide

Internationally, multiple programs to develop radio communications technology are based upon *efficient* spectrum use.

One such program is the development of Future Public Land Mobile Telecommunications Services (FPLMTS), for which a standard is expected by 1994-1995, and for which equipment is expected to be fielded by 1995-1996.

Two other programs are the Aircraft Correspondence Service (ACS) and low-earth-orbiting satellites systems (LEOSS).

All three compete for the spectrum resource.

In an amusing way, the new era brings with it a "new" terminology that really is only an echo from radio technology's history.

These days, the word "wireless" has replaced "radio" in descriptions of personal communications services. Radio, in the earliest days of Hertz and Marconi, was referred to as "wireless."

Another peculiar twist is that, with the advent of this year's "new" technology, what was referred to as *digital* last year now is described in marketing literature as *analog*. This year's digital technology, you see, is the one and only "true" digital technology.

PCS, ANDC, FPLMTS, ACS,

Table 1—Bandwidth efficiency values.

Bandwidth Efficiency Value	Required Carrier-to-Noise Ratio (CNR)
1.0 b/s/Hz	1.0dB (1.25)
2.0 b/s/Hz	5.0dB (3.15)
3.0 b/s/Hz	8.0dB (6.3)
4.0 b/s/Hz	12dB (15.8)
5.0 b/s/Hz	15dB (31.6)
6.0 b/s/Hz	18dB (63)

Note: These values reflect rounding.

cess is not standing still. In the realm of radio communications for public safety organizations (law enforcement agencies, fire departments and emergency medical services), the Associated Public-Safety Communications Officers (APCO), a South Daytona Beach, FL-based trade association, is spearheading *Project 25*. The project's objective is to develop and promulgate a standard for the next generation of advanced narrowband digital communications (ANDC) for public safety radio communications.

No wonder we are on the verge of a new era, a communications revolution with a voracious appetite for the emerging proliferation of low-cost,



ANTENNA CATALOG

MAXRAD
State of the Art Antennas

MAXRAD, Inc.
4350 Chandler Drive
Hanover Park, IL
60103 USA
Order: (800) 323-9122
Voice: (708) 372-6800
Fax: (708) 372-8700

Circle (18) on Fast Fact Card

♦♦♦ **Follow the Leader**

LEOSS and the rest of the alphabet soup digital radio communications services depend upon the successful commercial exploitation of bandwidth- and spectrum-efficient technologies. Most of these services depend upon powerful embedded signaling that, in concert with stringent voice quality objectives, places high demands on any technology—let alone those that are bandwidth-efficient.

Promise and peril

With spectrum refarming comes the *great promise*: the expansion of available discrete channels by 300%-500%.

Regardless, is increased channel availability the real benefit of spectrum refarming? No.

The real promise of refarming is the stimulation of advanced digital communications technology that will revolutionize personal communications.

If developers are given an incentive

to pursue bandwidth- and spectrum-efficient technologies, one of the many benefits likely to result from the proliferation of advanced digital communications technology is the use of fully

efficiency and *bandwidth* efficiency with respect to narrowband radio technology.

Bandwidth efficiency refers to a given channel bandwidth's information capacity. Researcher Claude Shannon has published extensive studies of bandwidth efficiency, and a given bandwidth's information capacity often is referred to as its *Shannon channel capacity*.

Systems using modulation and channel coding techniques operating at

data rates significantly less than the Shannon channel capacity are not as bandwidth-efficient as those using methods that approach the Shannon limit.

In contrast with bandwidth efficiency, spectrum efficiency refers to a *mission* or *use* and takes into account much more than mere bandwidth quantity; nevertheless, unless channel band-

Table 2—Bandwidth efficiencies for several levels of quadrature amplitude modulation.

Modulation	Theoretical Bandwidth Efficiency	Attainable Bandwidth Efficiency
4-QAM	2 b/s/Hz	2 b/s/Hz
16-QAM	4 b/s/Hz	3.8-4 b/s/Hz
64-QAM	6 b/s/Hz	5.7-6 b/s/Hz

embedded signaling and the integrated transmission of voice and multimedia digital data.

Spectrum and bandwidth efficiency

In the spectrum refarming *NPRM*, the FCC refers to both spectrum-efficient technology and "narrowband" technology. It is important to recognize the differences between *spectrum*

part 88 compliant—today!

WHEN TRAGEDY STRIKES, LACK OF COMMUNICATION IS A REAL DISASTER



Whether it's co-ordinating Search and Rescue teams or dealing with ground relief support groups, a portable communications system is an absolute priority in times of emergency.

The Tait Portable Repeater Station has been designed to be put into action immediately, effectively. Light, robust and 'showerproof', the Portable Repeater Station can handle a network of mobile and handheld radio transmissions in the most remote of terrain.

Wherever life is in danger, the Tait Portable Repeater Station brings the promise of help.



Tait Electronics U.S.A. Inc.

9434 Old Katy Road, Suite 100
Houston Texas 77055 USA Phone (1) (713) 984-86
Outside Texas 800 222-1255 Fax (1) (713) 468-69

Circle (19) on Fast Fact Card

Now When Your ANI Talks...

EMERGENCY!
UNIT 1082
MAN-DOWN



The Whole Fleet Listens!

Introducing Automatic Voice Alerting, Only From Cimarron Technologies

When the situation turns critical, your people need to know about it. Fast. That's why our Automatic Voice Alert system sounds the alarm with synthesized voice, over your radio channel or local PA. Quickly and accurately, so everyone gets the word.

HERE'S HOW IT WORKS

Your GE-STAR® equipped radio sends the push-button

Emergency or Man-Down ANI message in less than a half-second. Our C-MARK dispatch display then decodes the digital message, sounds an audible alarm, flashes the unit ID and message display, and logs it to a printer.

AND NOW HEAR THIS

Then the C-MARK, with Automatic Voice Alert, keys the dispatcher's radio and broadcasts the unit number and critical message phrase back over the channel (contention free), as well as to its internal speaker or your local PA.

SE HABLA ESPANOL... PARLEZ VOUS FRANCAIS
Plus, our Automatic Voice Alert can be optionally supplied with any phrases, in any language you choose. So the message gets across, wherever you are.



The C-MARK II dispatch display sends Automatic Voice Alert messages back over the air

Automatic Voice Alert works with our TAG-1 ANI encoders, or in any GE-STAR® compatible ANI system.

AND THERE'S MORE

We offer the most feature filled and innovative GE-STAR® compatible ANI in the industry. To find out more, call toll-free in the U.S. 1-800-487-7184 or (619)-738-3282.

TAG-1 ANI encoder sends Emergency and Man-Down messages from your remote radio

**CIMARRON
TECHNOLOGIES**

GE-STAR is a registered trademark of General Electric Corporation

Circle (20) on Fast Fact Card

width is used effectively, ultimate spectrum efficiency can never be accomplished.

Efficiency example

For example, consider the relative spectrum efficiency of using AM broadcast band frequencies for radiopaging in an urban area.

Even if bandwidth-efficient technology is employed, using the medium wave band for urban paging is not spectrally efficient because the 160-meters-or-longer wavelengths are unsuitable for communications when building penetration is important.

Spectrum efficiency is *multidimensional*.

In narrowband frequency-division multiple-access (FDMA) systems and in hybrid systems with FDMA as part of a complex multiplexing scheme, bandwidth efficiency is a necessary component of spectrum efficiency. In the case of FDMA, spectrum efficiency may be viewed as an

integration of bandwidth-efficient technology using the ideal wavelength for transmission along with optimum channel coding and power densities, controlled interference frequency reuse and trunking.

Table 3—The relationship between bandwidth efficiency and power requirements for practical QAM systems.

QAM Bandwidth Efficiency	Carrier-to-Noise (CNR) Ratio Required
4-QAM @ 2 b/s/Hz	14dB
16-QAM @ 4 b/s/Hz	20dB
64-QAM @ 6 b/s/Hz	26dB

Taken as a composite, an FDMA-based communications system using optimum bandwidth-efficient technology, in addition to trunking and controlled interference frequency reuse, may be viewed as a "spectrally efficient" system.

What are the requirements of the underlying bandwidth-efficient technologies? Why are they important? They are important because the full promise of spectrum-efficient technology will not be delivered unless FCC rules are adopted that heavily favor the cutting edge of technological advancement. Instead, there will be a limited improvement and a lot of marketing hype.

The basis for this assertion is the Shannon limit.

Shannon limit: a power trade-off

With all of the excitement surrounding the wireless digital revolution, often one loses sight of the basic principles that dictate what techniques work and how well they perform in the physical world.

Digital transmission is most efficient when the source data and the channel use proper coding techniques.

Under those conditions, a channel of WHz bandwidth has a capacity *C* (for various RF carrier-to-noise ra-

RESONANT
CAVITY

FILTERS AND DUPLEXERS

IN RANGES FROM:

30 MHz - 960 MHz

IN RANGES FROM:

30 MHz - 1.3 GHz

VARI-NOTCH® BANDPASS

Our

bandpass, Series-Notch®, Vari-Notch® and combine resonant cavity filters have demonstrated long-term reliability and high performance in the toughest commercial radio sites in the world. From single-channel repeater sites to advanced multicoupler systems, our superior filter quality makes a difference.

SERIES-NOTCH®

NOTCH

With silver-plated resonator parts and heavy-gauge, heliarc-welded end caps,

our cavity and combine filters produce exceptional duplexer performance: 100 dB isolation at 240 KHz separation in the VHF range; 100 dB UHF isolation at 5 MHz separation with four 4" cavities; Wideband VHF, UHF, 800 MHz and GSM duplexers for trunking and radiotelephone system applications.

60

PUBLISHED
MODELS



MULTICOUPLER SYSTEMS • SIGNAL BOOSTER SYSTEMS • DUPLEXERS • CAVITY FILTERS • RF SYSTEM PRODUCTS

TX RX SYSTEMS INC. 8625 INDUSTRIAL PARKWAY, ANGOLA, NY 14006
TELEPHONE 716-549-4700 FAX 716-549-4772 (24 HRS.)

The Good, The Bad, & The Ugly.



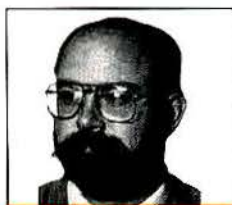
Paul Dobosz
Clear Channel Commun.

"Extremely fast shipment—often here the next day, never more than two days. Keep up the good work!"



Jerry Goetz
Kentucky Utilities Co.

"Your quotes are fast. Delivery is fast."



Carl Davis III
NV St. Dept. Envir. Consv.

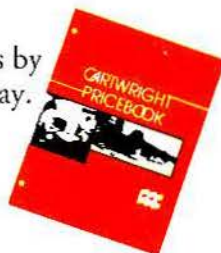
"Having guaranteed prices right next to the item in the catalog is great. I find the photographs of products very helpful at times."

Several times a year, Cartwright Communications sends a questionnaire to their entire customer list asking, "How are we doing?" In Fact, Cartwright asks their customers to "tell it like it is, no matter whether it's good, bad or ugly". Cartwright listens very closely because we value our customers' opinions. Here are some of the responses.

We Deliver Value!

1-3 Day Delivery Nationwide. Call us by 3:00pm E.T. and we'll ship the same day.

Call for our free Pricebook with guaranteed prices for 3 months.



CARTWRIGHT
COMMUNICATIONS COMPANY

800-543-8614

**Your ready source for Andrew, A/S,
Celwave and Decibel Products.**



David Williams
Williams Communications

"Your company has been perfect on orders."



Joanne Miller
Tower Communications

"We have no complaints regarding shipments, since most of the time, the merchandise arrives sooner than expected."



Saddam Hussein
Dictator of Iraq

"Cartwright? Those bums wouldn't even accept my order!!!"

tios [CNRs]) that may be calculated using Shannon Channel Capacity Theorem contained in the following equation:

$$C = W \log_2(1 + \text{CNR})$$

From this equation, bandwidth efficiency values from 1.0 b/s/Hz to 6.0 b/s/Hz have been calculated and are

shown in Table 1 on page 22.

Two bandwidth objectives

The FCC *NPRM* proposes two bandwidth objectives, a 4.0kHz occupied bandwidth within a 5kHz channel and a 5.0kHz occupied bandwidth within a 6.25kHz channel.

A 4.0kHz occupied bandwidth with an RF CNR of 25 (14dB, which is

typical in land mobile radio) has a theoretical data rate capacity of 18.8 kb/s, which equates to a bandwidth efficiency of 4.7 b/s/Hz. At an occupied bandwidth of 5.0kHz, the channel information rate increases to 23.5 kb/s.

Unfortunately, in practice, it is not possible to obtain the theoretical Shannon channel capacity. Still, it is possible to use channel coding and to fully exploit advances in digital signal processing-based (DSP) "brick wall" filtering that permits a highly efficient use of bandwidth.

Note the relationships among information capacity, bandwidth and power.

The Shannon theorem indicates that the easiest way to increase channel information capacity is to increase bandwidth *W*, and the most difficult way to increase the channel information rate is to increase the power. As a way of increasing the channel information rate, a power increase is at a disadvantage because channel capacity only increases with the logarithm of power.

Choices

Keep these choices in mind when you think about the proposals being advanced by the FCC and other regulatory bodies to restrict bandwidth and to limit power, ostensibly to promote increased bandwidth efficiency and spectrum efficiency. *If you limit the power, you must increase the bandwidth, or if you limit the bandwidth, you must increase the power.*

The key to effective exploitation of bandwidth efficiency, assuming that adequate power is permitted, is through the use of multilevel (m-ary) modulation or coding in which many information bits are encoded into each symbol transmitted. Thus, although in binary systems the information bit rate is equivalent to the transmitted baud rate, with m-ary coding the information rate conveyed is higher than the symbol baud rate.

The most promising m-ary technique is quadrature amplitude modulation (QAM). With QAM, bit rate capacity is determined by the number of phase and amplitude levels.

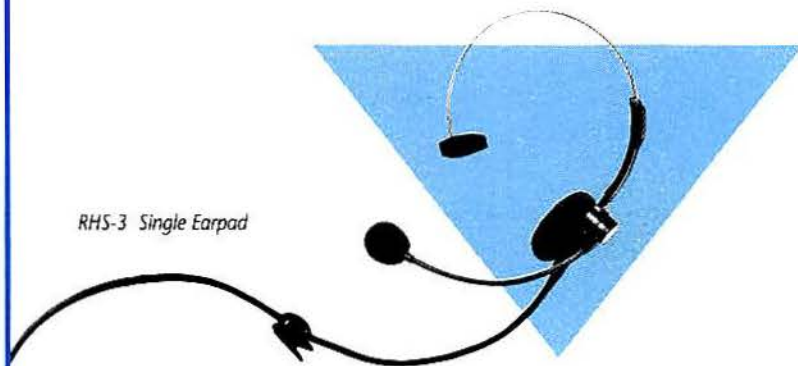
Much publicity has been directed at

Take Your Hands Off Your Radio!



Maximize your performance with the ease and comfort of hands-free radio operation! DTC's most advanced line of communication accessories are built to perform in the toughest conditions. Experience Engineering Excellence!

RHS-3 Single Earpad

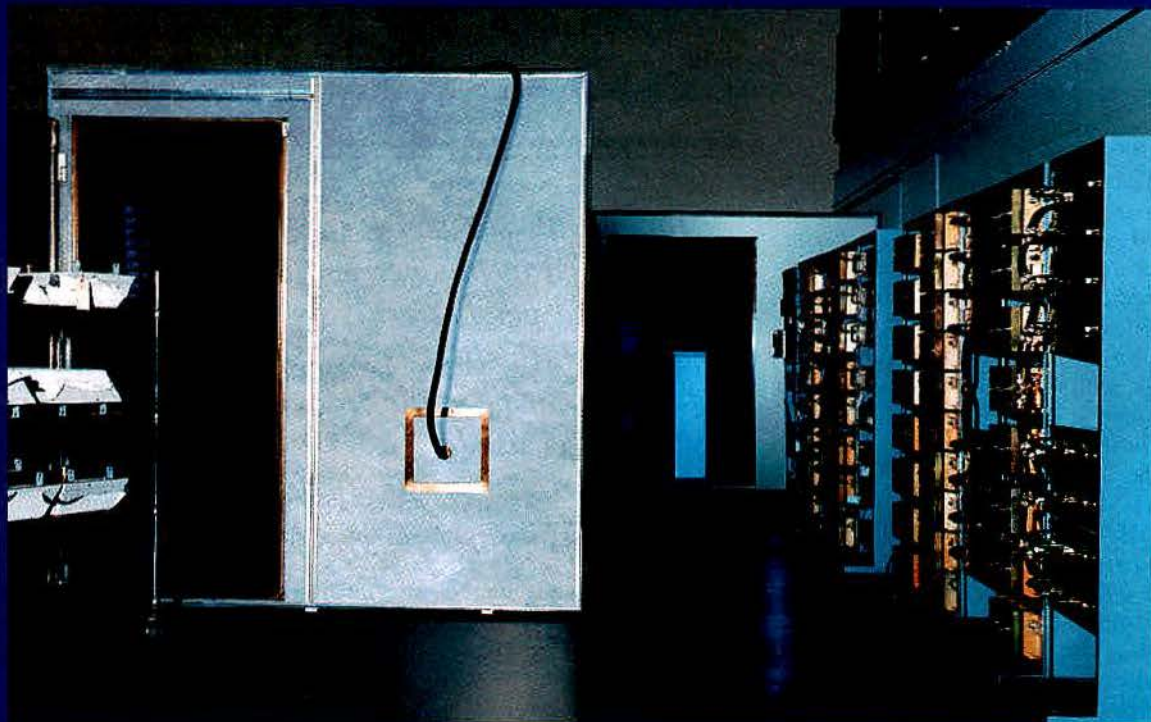


**DYNATECH
TACTICAL
COMMUNICATIONS, INC.**

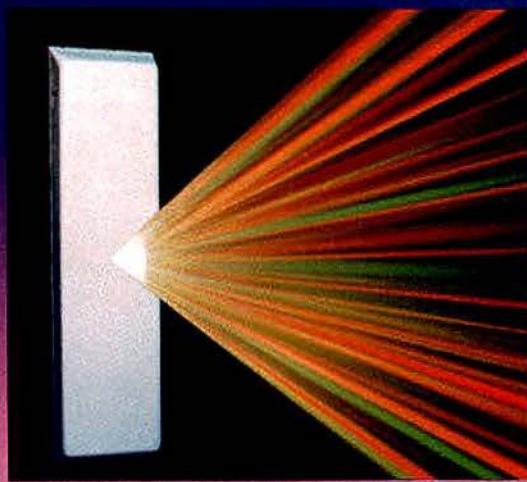
16 Hampshire Dr., Hudson, NH 03051 **1-800-233-8639**

Circle (23) on Fast Fact Card

Decibel's Directional Panels Pass Anechoic Chamber Tests!



800-901
coverage via 3
large beam tubes.
Upper lobe
suppression of 18
dB below main
lobe reduces
interference.
810-901 MHz.
12.5 or 15.5 dBd
gain (14.6 or 17.6
dBi). 12" (305
mm) wide and
only 2.6" (66
mm) deep!



**Dedicated to the Fine Art
of Radiation Management!**

a member of the ALLEN TELECOM GROUP



DECIBEL PRODUCTS

Before they're shipped to you, Decibel's Cellular Panel Antennas — like all of our 800-900 MHz base antennas — must pass our anechoic chamber tests for power rating compliance and the absence of intermodulation generators.

So you can rely on Decibel's outstanding quality and the industry's broadest line of panel antennas. Only Decibel offers them in one, two, three, four, six and eight foot lengths, all 12" (305 mm) wide and 5" (127 mm) deep. With up to 120° coverage and 5 to 16 dBd gain. 8-foot triples, too. Use the toll-free HOTLINE to FAX us your requirements:

1-800-229-4706

P.O. Box 569610, Dallas TX 75356-9610 • Order Hotline 1-800-676-5342 • FAX 1-800-229-4706 • Phone (214) 631-0310 • FAX (214) 631-4706

*Warehouses that are qualified and certified to stock and tune certain filter products.

Factory Authorized Warehouses: Antenna Farm, Overland Park KS; Cartwright Communications*, Cincinnati OH; Communications Associates, Joliet IL; Communications Express, Clifton NJ; Communications Works*, Denver CO; Hutton Communications*, Dallas TX, Norcross GA; Marktronics*, Sunrise FL; Primus Electronics, Joliet IL; Talley Electronics*, Hayward CA, Santa Fe Springs CA, San Diego CA, Phoenix AZ, Tescos*, Hunt Valley MD, Sparks NV. In Canada, Allen Telecom Canada, Pickering, Ontario.

Visit us at IWCE, Booth #820 & Telocator, Booth #530.

Circle (24) on Fast Fact Card

$\pi/4$ DQPSK modulation, even though as a form of QAM, it really only represents the entry level of bandwidth efficient modulation.

Coding level

Bandwidth efficiency expressed in bits per second per hertz bandwidth (b/s/Hz) is a function of the coding level used. In this discussion, it is assumed that the coding and information transfer rate of the symbols transmitted do not exceed the Nyquist rate. Thus, with 4-QAM (four-level QAM), the theoretical efficiency is 2 b/s/Hz.

These relationships are presented in Table 2 on page 24.

As shown in Table 2, 16-QAM would have a maximum theoretical bandwidth efficiency of 4.0 b/s/Hz. The 64-QAM mode would have an information capacity of 6.0 b/s/Hz. Within the FCC-proposed occupied bandwidths of 4.0kHz or 5.0kHz, effective data rates of at least 22.8 kb/s can be achieved with 64-QAM.

For practical QAM systems, the re-

lationship between bandwidth efficiency and power requirements in terms of carrier-to-noise ratio in a double-sided Nyquist bandwidth that

*Bandwidth efficiency
expressed in bits per
second per hertz
bandwidth (b/s/Hz) is a
function of the coding
level used.*

equals the transmit symbol rate for a 10⁻⁶ bit-error-rate (BER) are presented in Table 3 on page 26.

Efficiency vs. power

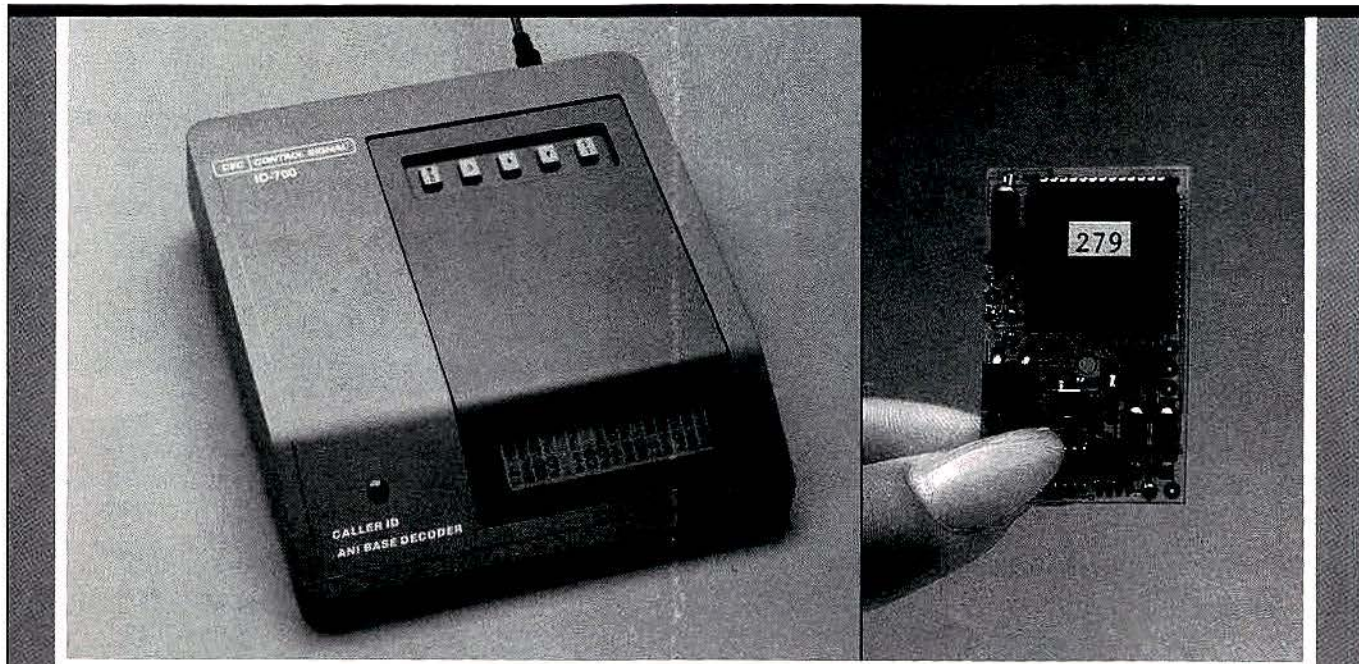
The figures in Table 3 show that although the power efficiency of bi-

nary or even 4-ary signaling is fairly good, very high bandwidth efficiencies require significant power increases.

In this example, to use 4-QAM initially and then to migrate to 16-QAM and maintain the same error performance, a 6.0dB (factor of four) increase in power is required. Of course, narrowband systems have greatly reduced detection bandwidths, thus accruing a "power" advantage.

Detractors of narrowband and bandwidth-efficient technologies claim that a mobile communications channel is characterized by phase and amplitude distortions of such a degree that they make the use of "high-level" very bandwidth-efficient modulations, such as 16-QAM or better, impossible.

Such claims are indefensible and ignore the tremendous advancements in phase and amplitude perturbation correction made during the last 20 years that allow a complex Rayleigh-log normal channel to become a first-order time-invariant Gaussian channel. Such channel linearization techniques



The Party's Over: Caller ID for Radio Systems

DIGITAL ANI

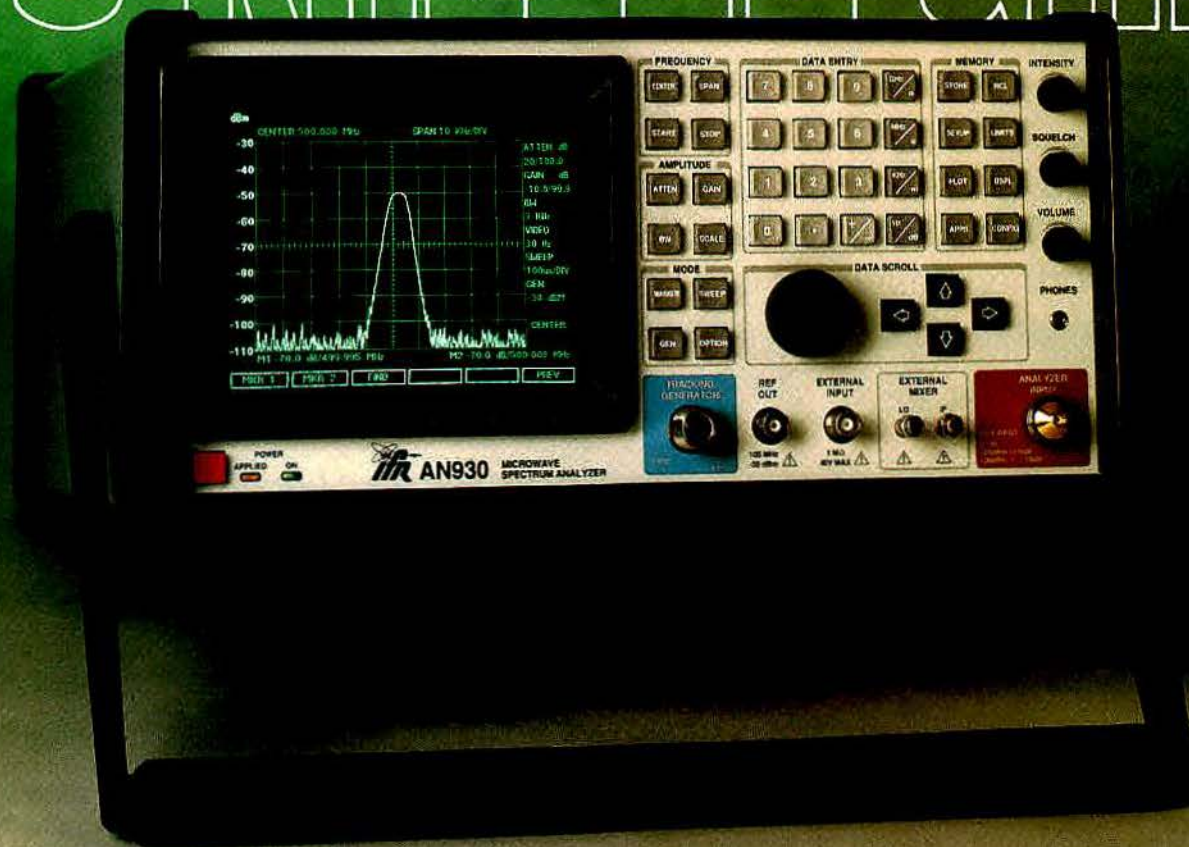
Stops the horseplay and stuck mikes. Has RS232 and printer ports. Encoders start at \$69 per mobile. For brochure call 800-521-2203.

CSC CONTROL SIGNAL®

1985 S. Depew St., Unit 7, Denver, CO 80227
(303) 989-8000

Performance and value beyond anything in its class...

9 kHz-22 GHz



AN930 MICROWAVE SPECTRUM ANALYZER

At last, a high performance microwave spectrum analyzer that's truly portable and affordable.

Featuring low-order, preselected mixing and a highly stable synthesized RF system, the AN930 provides superior amplitude and frequency measurement performance over its entire 9 kHz to 22 GHz frequency range. Support for external mixers extends the AN930 measurement range beyond 22 GHz. A high impedance input permits measurement of baseband signals to 0 Hz and 40 volts peak amplitude.

Logical front panel controls on the AN930 reduce most measurements to a few simple steps. A powerful micro-processor provides advanced tools to simplify the solution of many complex measurements. The large, easy-to-read, 7-inch display speeds viewing and interpretation of measurements.



STANDARD FEATURES INCLUDE:

- +30 dBm to -120 dBm measurement range, 300 Hz to 30 MHz analog resolution bandwidth, 3 Hz to 100 Hz digital resolution bandwidth, built-in 1 Hz resolution frequency counter, high speed time-domain sweep with pretrigger and delayed trigger, sensitive AM/FM receiver, RS-232 and IEEE-488 interfaces, and operation from DC power.

OPTIONAL FEATURES INCLUDE:

- Rechargeable battery pack, built-in 2.9 GHz tracking generator, internal memory expansion (up to 99 traces and control setups plus 64 kbyte user-definable macro storage memory), 200 Hz to 1 MHz supplemental resolution bandwidth filters including EMI bandwidth filters, quasi-peak detector, and 0.02 ppm high stability time base.

For more information or a demonstration, contact your local IFR distributor or representative, or call IFR directly at 316/522-4981.

IFR SYSTEMS, INC.

10200 West York Street / Wichita, Kansas 67215-8935 U.S.A.
Phone 316/522-4981 / TWX 910-741-6952 / FAX 316/524-2623

CRAFTED WITH PRIDE IN
USA

as feed forward signal regeneration (FFSR) and transparent tone in-band (TTIB), developed in the early 1980s by Dr. Joseph McGeehan and Dr. Andrew Bateman, are the best examples today of such practices and are proven in their effectiveness.

In McGeehan's 1980s FFSR-TTIB research, the use of 16-QAM modulation for very low error (10⁻⁶ BER)

transmission at approximately 13 kb/s in a 3.4kHz occupied bandwidth was demonstrated at 400MHz under Rayleigh faded conditions at a vehicle velocity of approximately 100 km/h. McGeehan obtained this performance level without using any error detection and correction (EDAC) and simply relied upon the FFSR-TTIB channel linearization techniques to provide a

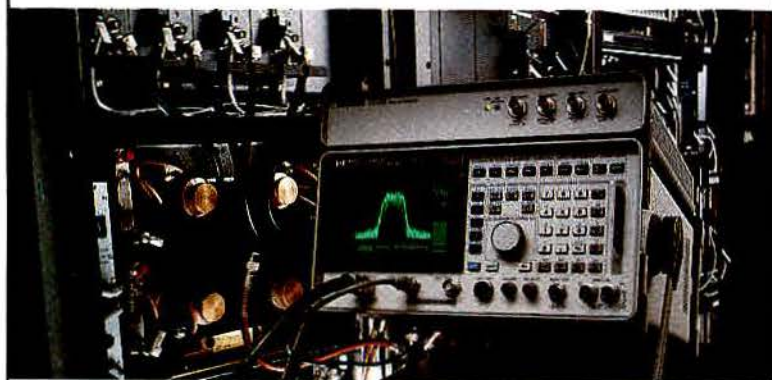
solid time-invariant channel.

Refarming-driven technologies

The research is relevant to spectrum refarming because the FCC is proposing major changes in how private land mobile radio (versus public or radio common carrier) services below 512MHz are regulated and how they operate.

Two emission masks are proposed, one for 5.0kHz channel spacing in the 72MHz-222MHz frequency bands, and a second emission mask for 6.25kHz channel spacing in the 412MHz-520MHz frequency band. Occupied bandwidths are limited to 4.0kHz with 5.0kHz channel spacing and 5.0kHz with 6.25kHz channel spacing.

At last, a cell site tester that speaks Motorola, Ericsson, AT&T, GE, Northern Telecom, and Bob.



To optimize your cell site, the new HP 8921A/D not only speaks to major base stations. It speaks to you.

Thanks to software designed with your input, and a built-in computer, the HP 8921A/D is one of the most advanced, fully-automated cell site testers available.

It actually speaks back to you with hard-copy results in formats you defined so you don't waste time writing it down. It displays set-up diagrams and tuning diagrams and checks manufacturer's specs for you. And it directs the base station during testing so you and your laptop computer are free to do other things. In short, tests virtually run themselves so you have more time for troubleshooting and optimizing.

The HP 8921D also speaks to the future because it adds the HP 83201A for use in TDMA digital cellular formats. For a free technical data sheet, call our technicians at 1-800-452-4844, ext. 7359*. They'll give you the information you need. After all, they speak your language.

© 1993 Hewlett-Packard Co. TMSPK02/MIC

There is a better way.



**HEWLETT
PACKARD**

*In Canada call 1-800-387-3867, Dept. 464

The proposed narrower FDMA channels do not require the use of digital technologies.

Under this scheme, the proposed emission masks will provide 40dB of attenuation at the edge of the authorized channel (not bandwidth), 50dB of attenuation at the edge of the authorized bandwidth of the adjacent channel and 65dB of attenuation beyond those points.

Digital not necessary

The proposed narrower FDMA channels do not require the use of digital technologies. Depending upon how the power level issue is resolved, analog single-sideband may prove to be the only really viable technology. In fact, single-sideband in the form of amplitude companded single-sideband (ACSSB), a 50-year-old technique, is a likely and potentially aggressive candidate that may provide cost-effective narrowband communications in these narrower channels.

To implement digital bandwidth-efficient techniques that can support reasonable data rates such as 9.6 kb/s in a 4.0kHz or 5.0kHz occupied bandwidth in an economical way, vendors



MOTOROLA
Land Mobile Products Sector



FLASHport™

The future of radio communications is here now.

Imagine having a new radio whenever you need one.

Imagine FLASHport™ radios. A way for you to purchase the radio you need today and to upgrade tomorrow with additional features or future enhancements by simply loading new software.

With FLASHport, we believe your radio need never become obsolete by new technology. You buy what you need now, and add the features you want as your needs change in the future. Instead of buying a brand new radio, you simply purchase and load new software into your FLASHport radio. Similar to

how personal computer users load software into their PCs to get the most out of their PCs.

FLASHport technology incorporates Motorola's proprietary ROS/VRIS™ operating system and is exclusively available on many of

our two-way radios: MTS 2000™, SABER™ SI, ASTRO™ SABER, ASTRO™ Spectra, plus other planned future products.

To learn more about the future of radio communications today, just contact us.



FLASHport™



MOTOROLA

Land Mobile Products Sector
1301 East Algonquin Road
Schaumburg, IL 60196
Phone: 1-800-635-9837

Ⓜ Motorola, ⚡ FLASHport, SABER, ASTRO, SPECTRA, MTS 2000 and ROS/VRIS are registered trademarks of Motorola, Inc.

Circle (28) on Fast Fact Card

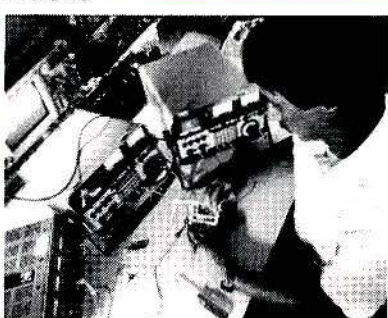
The



Complete



Mobile



Communications



Distributor

CA Communications Associates Inc.

305 N. Republic Ave. P.O. Box 2399 Joliet, IL 60434
(800) 435-9313 Order Fax (800) 284-4934

You Can Depend On Us!

As one of the largest and oldest distributors of mobile communications products in the U.S., Communications Associates can ensure that you'll receive competitive pricing, quick shipment and excellent service every time you call.

So stop searching for a distributor you can depend on, and discover why thousands of dealers, self-maintained end-users and carriers across the country choose CA as their complete mobile communications source. **You Can Depend On Us!**

Q
u
a
l
i
t
y

P
r
o
d
u
c
t
s

F
r
o
m:

3M
AdvanceTec
Allgon Mobile
Amphenol
Andrew
Antenex
The Antenna Co.
The Antenna Specialists Co.
Astron
Autotalk
A.W. Enterprises
Bee
Berkshire
Cablewave
Cellabs
Celwave
Centurion
Cobra
Communications Specialists
Curtis
Cushcraft-Signals
db Mobile
Decibel
Dennison Bar-Lok
Easy-Up
GE Cellular
GE Mobile
GoldStar
Harger
Helper
IFR
JaBRO
Maxon
Maxrad
Merry
Microlect
Mitsubishi DiamondTel
Mitsubishi International
Multiplier
Newmar
Ora
Pace
Panasonic
PanaVise
PolyPhaser
Pro-Fit International
RF Industries
Ritron
SatPak
Scanner Master Books
Scientific Dimensions
Selectone
Shinwa
Shure
Signetics
SMC
Speco
SSC
Statpower
TCC Industries
Technophone
Telwave
Terk Technologies
Term Con
TPI
Trapunto
Triplett
Tripp Lite
Uniden

may be expected to use a linear system architecture.

Methods may include DSP-based direct conversion or up-conversion linear frequency translation in concert with high-level digital modulation such as 16-QAM and may use certain adaptive channel linearization techniques such as McGeehan's TTIB with FFSR. The result would be a very bandwidth-efficient digital implementation of a direct linear frequency conversion with a bandwidth occupancy at radio frequency proportional to the baseband bandwidth that has been frequency-translated. Even then, QAM power requirements must be met.

Multimedia applications

To accommodate emerging multimedia applications involving digital voice, digital text and digital imagery and video, these bandwidth-efficient digital implementations are necessary to exploit the very limited occupied bandwidths proposed with either the 5.0kHz or 6.25kHz channels. Such multimedia applications easily could necessitate the use of 64-QAM, which could provide information transfer rates as high as 24 kb/s to 30 kb/s in the FCC-proposed narrowband channels.

Effective use of narrowband channels requires the use of bandwidth-efficient techniques that demand more power than their inefficient counterparts. To support the demands of the user population for multimedia information transport, very highly bandwidth-efficient techniques are required.

There is a need for feed-forward automatic frequency control techniques and DSP-controlled power amplifiers to maintain system integrity.

Most important is the absolute acceptance and use of linear system architectures. The pioneering work performed during the last decade by McGeehan and Bateman from the University of Bristol in the UK only scratches the surface of the potential of linear transmission. Only by linearizing the heretofore corrupted wireless environment will the full exploitation of the works of Shannon and the maximum use of the radio spectrum resource be allowed.





Imagine having a new radio whenever you need one.

Imagine FLASHport radios.

The average radio lasts seven to ten years. Yet communications technology can change almost overnight. That's why you need FLASHport.™

Now the radio you purchase today can be updated tomorrow with additional features or future technology enhancements by simply loading new software.

With FLASHport, we believe your radio need never become obsolete by new technology. You extend your FLASHport radio's useful life by adding the features you want as your needs change in the future. Instead of buying a brand new radio, you

simply purchase and load new software into your FLASHport radio. Similar to how personal computer users load software into their PCs, to get the most out of their PCs.

FLASHport technology incorporates Motorola's proprietary ROS/VRIS™ operating system



and is exclusively available on many of our two-way radios: MTS 2000™, SABER™ SI, ASTRO™ Saber, ASTRO™ Spectra, plus other planned future products.

Plan now for the future by keeping your radio forever up to date. To learn more just contact us.



MOTOROLA

Land Mobile Products Sector
1301 East Algonquin Road
Schaumburg, IL 60196
Phone: 1-800-635-9837

© Motorola, FLASHport, SABER, ASTRO, SPECTRA, MTS 2000 and ROS/VRIS are registered trademarks of Motorola, Inc.

Circle (30) on Fast Fact Card

Intermittent-duty repeater for emergency use

Modifications to Motorola and General Electric mobile radios convert them into repeaters suitable for emergency use. The modifications only take a few minutes and can be reversed easily to restore the units for mobile service.

By Terry W. Ellis

When an emergency calls for an intermittent-duty repeater, it can be made by modifying a GE MASTR II mobile radio or a Motorola Mitrek mobile radio in about 30 minutes. Figure 1 to the right is a block diagram that shows the principle elements of the conversion.

The modification requires only a few parts, which are listed on page 42. The modification works for lowband VHF, highband VHF and UHF frequencies.

The modified mobile radio can be used as a mobile or base repeater with two antennas or with one antenna and a duplexer.

The intermittent-duty repeater can be used with or without continuous-tone controlled squelch system (CTCSS) tones. Motorola calls CTCSS private line (PL). GE calls CTCSS channel guard (CG).

The repeater converts back to a mobile radio in no more than 10 minutes.

Use a complete mobile radio, one with a control cable, speaker, control head and all mounting brackets. These can be mounted on a wooden board or

on the unit's top cover.

Ac or dc cooling fans and a power supply are needed if the unit is to be used as a base repeater.

Modification kit

The modification kit consists of a 12Vdc relay, power n-channel metal oxide semiconductor field effect transistor (MOSFET), dropping resistors

rated from the receiver, and each must be provided with separate inputs.

The transmitter must be prevented from switching off the receiver when the transmitter keys.

The receiver is configured to key the transmitter using an output from the CTCSS board on a unit that has one. On a non-CTCSS Motorola Mitrek, an output is taken from the junction of

R422 and C434. On a GE MASTR II, the output is taken from the R.U.S. connector. This output triggers the n-channel power MOSFET gate, which in turn keys the transmitter by grounding the push-to-talk (PTT or sec PTT) line through the relay. The power MOSFET isolates the transmitter from the receiver. (See Figure 2 on page 38.)

The receiver audio is taken from the speaker output and used to modulate the unit's exciter. Capacitors isolate the two systems (receiver and transmitter audio). The volume control sets the 100% modulation deviation to 3.5kHz.

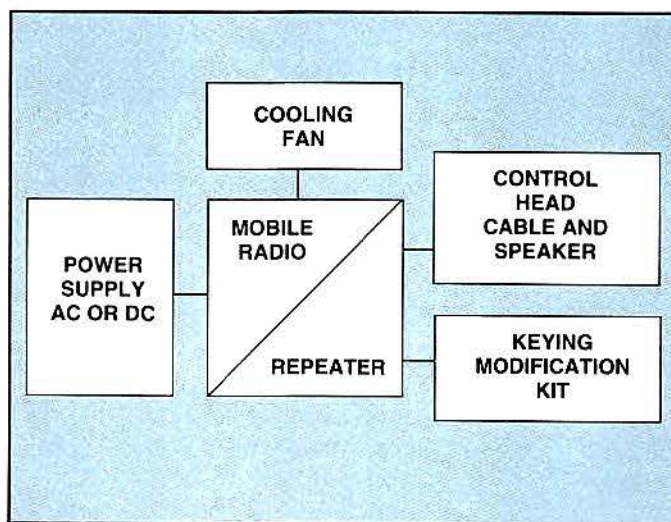


Figure 1. The principle elements for converting a mobile radio into a repeater include a power supply, a cooling fan, a control head cable and speaker and a keying modification kit configured as shown.

for the MOSFET gate input and, for the GE mobile, a capacitor to smooth out the gate pulse and couple audio to the exciter. The Motorola Mitrek has isolation capacitors in its audio circuit.

Theory

To convert a mobile unit into a repeater, the transmitter must be sepa-

Motorola Mitrek

The Motorola Mitrek is easier to convert than the GE unit because the CTCSS board (HLN 4181 A) encodes and decodes simultaneously.

The modification kit can be mounted on a small circuit board, either etched or wired point to point. Wiring for the

Ellis is a radio technician with City/County Communications, Spartanburg, SC.



Imagine a radio that adapts to your changing needs.

Imagine FLASHport radios.

It used to be you bought a radio hoping it had everything you needed for now and years to come. So you either overbought features or planned on a short lifespan. Then came FLASHport.™

Now with FLASHport, the radio you purchase today can be flexible enough to be upgraded tomorrow with additional features or future technology enhancements by simply loading new software.

Instead of buying a brand new radio, you can simply purchase and load new software into your FLASHport radio. Similar to how personal computer users load software into their PCs to get the most out of their PCs.

Buy only what you need today, and grow as your needs grow. Even provide the same radio hardware to all users, but vary application software according to the needs of different groups within your department. And do it all yourself.

FLASHport technology incorporates Motorola's proprietary ROS/VRIS™ operating system



and is exclusively available on many of our two-way radios: MTS 2000™, SABER™ SI, ASTRO™ Saber, ASTRO™ Spectra, plus other planned future products.

To learn more about how you can change your mind tomorrow, without needing to change the radio hardware you buy today, just contact us.

 **FLASHport™**



MOTOROLA

Land Mobile Products Sector
1301 East Algonquin Road
Schaumburg, IL 60196
Phone: 1-800-635-9837

Motorola, FLASHport, SABER, ASTRO, SPECTRA, MTS 2000 and ROS/VRIS are registered trademarks of Motorola, Inc.

Circle (31) on Fast Fact Card

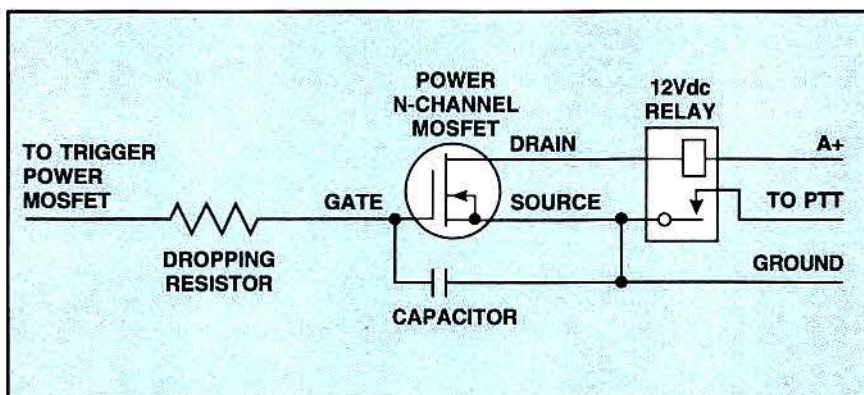


Figure 2. Receiver output triggers the transmitter by grounding the PTT line through a power MOSFET and relay for isolation. The text explains where in the radio to connect for receiver output.

kit is plugged into the receiver and transmitter metering sockets. (See Figure 3 on page 40.) Then the kit is placed within the unit.

The modification kit should be shielded as much as possible to exclude stray RF and to prevent intermodulation. All normal grounding and shielding practices should be observed.

Diode CR2 on the interconnect board and diode CR2 on the receiver board either are cut, or one side of each diode is lifted from the board. Opening these circuits isolates the receiver from the transmitter by opening the audio mute line and the sec PTT line.

Solder the only wire that does not go to the metering socket to pin 30 of integrated circuit (IC) U1 on the

CTCSS board. This wire is the lead that goes to the power MOSFET gate.

If no CTCSS board is installed, then take the gate input from the junction of R422 and C434 on the receiver board.

The wiring for the transmitter metering socket J1002 is pin 2 ground; pin 7 A+; pin 9 PTT low; and pin 14 microphone high.

The receiver metering J1002 has only one output, pin 9 receiver audio, which goes to the transmitter metering socket pin 14 microphone high, as shown in Figure 3.

The modification kit hooks up to the metering socket as follows (See Figure 4 on page 40.):

- J1002 pin 7 A+ to relay coil and drain.
- J1002 pin 2 ground to source and common on the relay.
- J1002 pin 9 PTT low to the normally open contact on the relay.
- U1 pin 30, the active high detect from the CTCSS board, to the gate and dropping resistors.

SAVE TIME & MONEY use HUTTON!

Now that you've seen
what's under our roof...
check-out our capabilities!
Call today for your **FREE**
product selection guide.

1-800-442-3811

- ✓ Cable Connector Installations
- ✓ Duplexer & Filter Tuning
- ✓ High Inventory Levels
- ✓ Same Day Shipping
- ✓ Solar Sizing Service
- ✓ Product Demos (Outside Reps)
- ✓ Technical Assistance (Inside Reps)



Siemens Solar Industries

HUTTON
COMMUNICATIONS

Dallas, Texas
214-239-0580
FAX-239-5264
800-442-3811

Norcross, Georgia
404-729-9413
FAX-729-9567
800-741-3811

Hutton National
Humble, Texas
713-446-4050
FAX-446-5779
800-325-8950

Communications Works
Denver, Colorado
303-820-2929
FAX-820-2809
800-726-6245



Imagine a radio that keeps learning new technologies.

Imagine FLASHport radios.

Change is inevitable. Especially in radio communications technology. Until now, however, change was also expensive. Because it meant throwing away radios with outdated technology. Then came FLASHport.™

Now the radio you purchase today can be "taught" additional features or future technology enhancements by simply loading new software.

Whatever tomorrow brings—new trunking systems, new encryption features, APCO 25 digital standards—with FLASHport, you buy what you need now, and add the features you want as your needs change in the future. Instead of buying a

brand new radio, you simply purchase and load new software into your FLASHport™ radio. Similar to how personal computer users load software into their PCs to get the most out of their PCs.

FLASHport technology incorporates Motorola's proprietary ROS/VRIS™ operating system and is exclusively available



on many of our two-way radios: MTS 2000™, SABER™ SI, ASTRO™ Saber, ASTRO™ Spectra, plus other planned future products.

No matter what tomorrow's communications technology will bring. With a radio that "learns", you can be prepared. Just contact us.

 **FLASHport™**



MOTOROLA

Land Mobile Products Sector
1301 East Algonquin Road
Schaumburg, IL 60196
Phone: 1-800-635-9837

© Motorola, FLASHport, SABER, ASTRO, SPECTRA, MTS 2000 and ROS/VRIS are registered trademarks of Motorola, Inc.

Circle (33) on Fast Fact Card

WHEN IT COMES TO DTMF... NOBODY DOES IT BETTER!

MODEL NC401

MICRO-MINIATURE DTMF DECODER

Three Decoders in one unit offering multiple user configurable output functions through microcontroller technology.

MODEL NC421

MULTI-FUNCTION DTMF DECODER

Enclosed in smartly styled plastic case with illuminated membrane control panel for mobiles.

MODEL NC4000

MULTI-FUNCTION DTMF DECODER

For control of remote applications, available with enclosure or 56 pin edge connector and a variety of options.

MODEL NC4004

MULTI-FUNCTION DTMF REPEATER

Capable of controlling 10 outputs while sensing 10 external inputs.

MODEL NC404

SUB-MINIATURE DTMF ENCODER

Digitally synthesized tone generator.

MODEL NC409

MICRO-MINIATURE DTMF ANI ENCODER

Exclusive Alarm and Man-Down features plus Transmit time-out timer, busy channel lock-out and microphone mute are only a few of the many features available in this microcontrolled unit.

MODEL NC410

NEW...DTMF ANI ENCODER DESIGNED WITH THE RCC IN MIND!

Simplifies telephone interconnects. 15 memory locations, last number redial, automatic connect/disconnect sequences and programmable "transmit refresh" provide easy operation in any mobile application.

**Call 1-800-874-8663
for complete information
and pricing.**

NORCOMM™
TONE SIGNALLING PRODUCTS

12438 Loma Rica Dr., Grass Valley, CA 95945

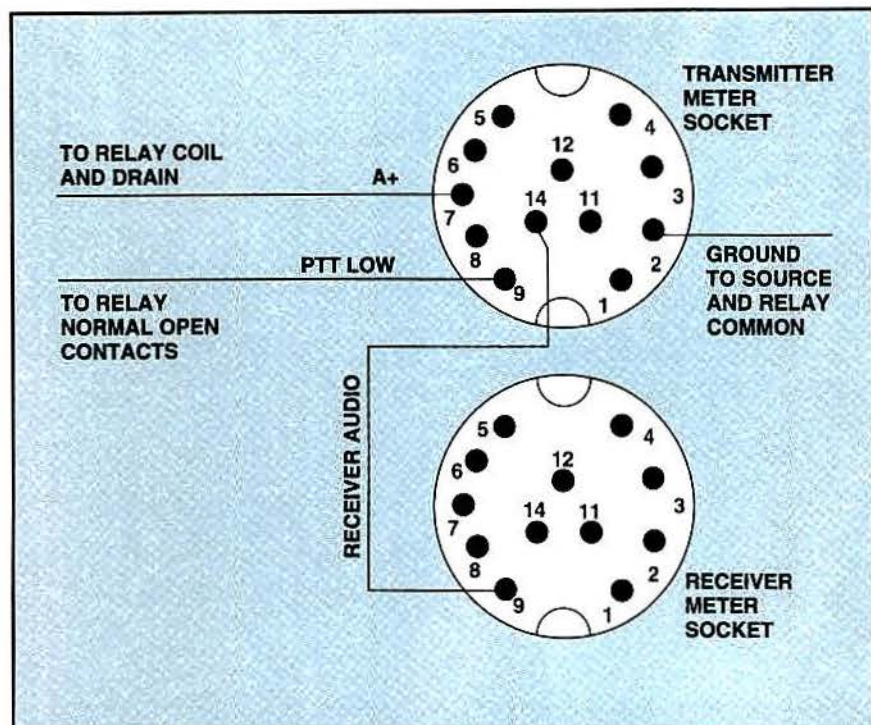


Figure 3. Wiring for the modification kit plugs into the Motorola Mitrek receiver and transmitter metering sockets as shown.

The transmitter modulation is set by the volume control for 3.5kHz maximum deviation.

GE MASTR II

On the GE MASTR II, two circuit runs on the control board must be cut. One is at U901 pin 6 Rx mute. The other is at pin 7 Rx OSC control.

Connect a jumper from J903 pin 11 10V reg to J903 pin 12 Rx OSC on the receiver board.

Cut two circuit runs at J908 pin 8 delay PTT on the receiver CTCSS board.

If CTCSS will not be used, the input

signal for the power MOSFET's gate can be taken from the carrier activity sensor, CAS J904 pin 9, or from the receiver unsquelch sensor, RUS J904 pin 8. PTT for the relay normally open contact is taken from J908 pin 8 delay PTT.

If the transmitter has a CTCSS tone, another CTCSS board, either the 19D432500G1 or the 19C331044G1 (both of which are smaller encode-only boards) is needed. The additional CTCSS board is connected as follows:

- P908 pin 4 10V reg to P907 pin 4 10V reg.
- P908 pin 6 delay PTT to P907 pin

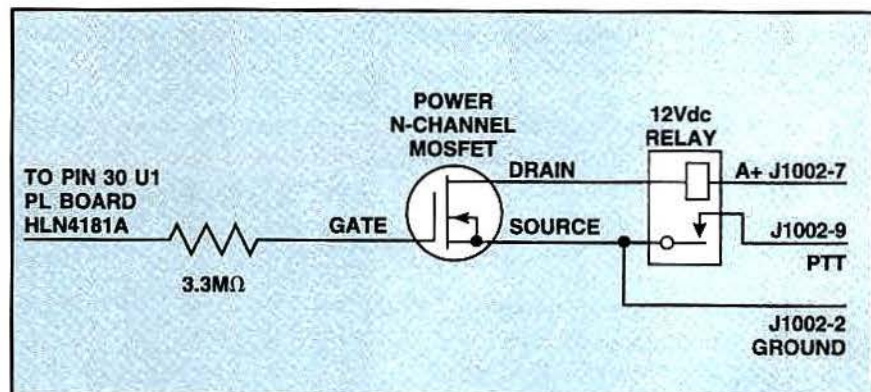


Figure 4. The modification kit connects to the Motorola Mitrek socket pins as shown.

Circle (34) on Fast Fact Card

POWER ON... with ASTRON.

Astron Corporation is the leading manufacturer of high-quality power supplies and converters for the land mobile industry.

With the new SL-11 series of low profile power supplies, specifically designed for base station applications, the setup is simple, easy and looks attractive. Just mount the radio, with the mounting pads (supplied with the power supply), to the top of the SL-11A (2 3/4" H x 7 5/8" W x 9 3/4" D) or the SL-11R (2 3/4" H x 7" W x 9 3/4" D). The power supplies are very well regulated and will provide 11 amps of current at a 50% duty cycle. The units have fold-back current limiting to protect them from overload and short circuit, and an overvoltage protection feature to protect the radio should the output voltage exceed a safe level. All SL series units are available in dark gray or black.

Power supplies and converters from Astron: our unsurpassed quality and reliability have made us the #1 choice in the communications industry.



ASTRON
CORPORATION

9 Autry, Irvine, CA 92718
Telephone: 714/458-7277
Facsimile: 714/458-0826

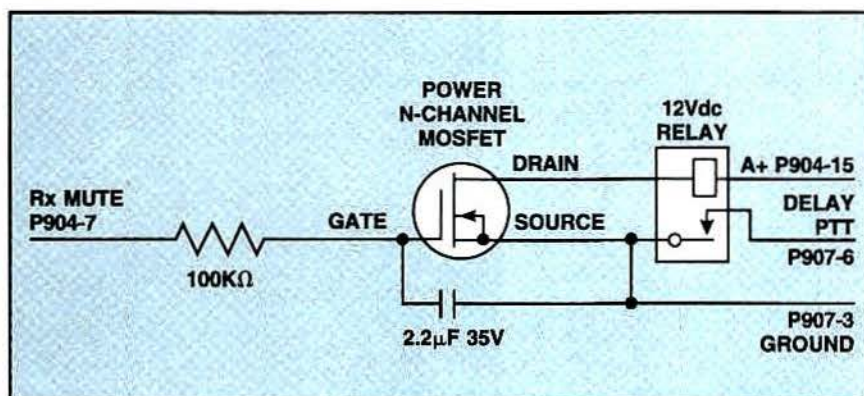


Figure 5. The modification kit connects to the GE MASTR II as shown. The 2.2μF capacitor smooths the gate pulse.

6 PTT.

□ P908 pin 7 PL tone out to P902 pin 2 PL tone HI.

□ P908 pin 9 A to P907 pin 3 A—.

The keying modification is connected as follows:

□ P904 pin 15 A+ to relay coil and drain on the power MOSFET.

□ P904 pin 7 Rx mute through resistor (100kΩ) to the power MOSFET gate.

□ P907 pin 3 A— to source and common on the relay.

□ P907 pin 6 PTT to normally open contact on the relay.

The 2.2μF capacitor is connected to the power MOSFET's gate and ground to smooth the gate pulse. (See Figure 5 above.) With this modification, the control head microphone can be used as a local microphone.

A 0.47μF 35WV capacitor goes be-

tween J904 pin 19 speaker HI and J902 pin 6 MIC HI for isolation between the transmitter audio and receiver audio.

The volume control sets the modulation level to 3.5kHz.

The repeater made from a modified Motorola Mitrek does not have audio that sounds as good as the audio from the repeater made from a modified GE MASTR II.

To improve the Motorola unit's audio, insert another CTCSS filter in line with the receiver's audio output and adjust the modulation control so more drive is required to modulate the transmitter to 3.5kHz.

The Motorola unit is more prone to intermodulation than the GE unit in this configuration. Adding filtering to the Motorola receiver's front end helps to alleviate the intermod. The front end from a GE MASTR II has been used successfully for this purpose.

The intermittent-duty repeater is for emergency use only, not for everyday use.

Parts list

1. Mobile radio: GE MASTR II or Motorola Mitrek.
2. CTCSS tone board (if needed): Two 19D432500G1 for GE MASTR II or one HLN 4181A for Motorola Mitrek.
3. Power n-channel MOSFET: Radio Shack No. 276-2072 OIRF-511 or equivalent.
4. 12Vdc relay: Radio Shack No. 275-241 0.1 AMP SPDT micro or equivalent.
5. Circuit board: phenolic for point-to-point wiring or printed.
6. Capacitor: 0.47μF 35WV (for GE MASTR II).
7. Power supply: 35A Astron RS-35 or equivalent, adjusted to the power level desired for the repeater.
8. Cooling fans: Ac or dc, depending on the installation.
9. Adapter or cables: The type required to connect the antennas or duplexer.
10. Resistors: 1MΩ, 1.1MΩ, OHN4M (Motorola), 100kΩ (GE MASTR II).
11. Wooden board: To mount radio, power supply and modification kit. (GE MASTR II.)
12. Metering plug: 1-80754A26. (Motorola.)



Advanced Features, New Design



The future of **EXTENDED LOCAL CONTROL** is here. The new model LE10 from CPI is a telephone style local extension designed for easy use with virtually any radio. The LE10 provides LED PTT indication, on-hook PTT capability, off-hook monitor, amplified speaker with volume control and adjustable amplified modulation output. The LE10 allows you to hear both sides of a transmission made from another desk-set or the radio microphone. The LE10 gives you all this in a newly styled modern package that brings extended local control into the 90's. Options: wall-mount

adapter, two channel control, intercom, on-hook monitor and plug-in power-pack.

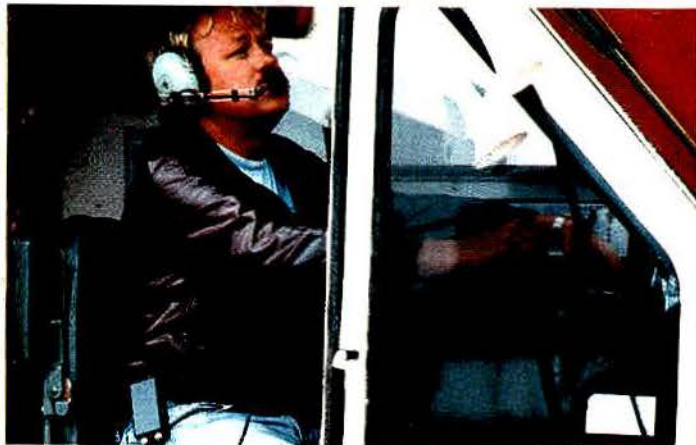
Features

- Separate RX and TX amplifiers
- Radio transmission monitored on LE10 speaker
- New modern styling
- One watt receive audio amplifier
- Use up to 1000 feet from base station

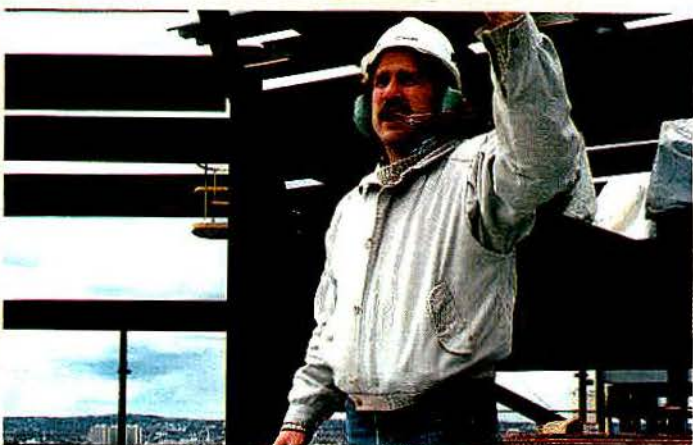


1186 Commerce Drive • Richardson, TX 75081
(214) 437-5320 • FAX (214) 437-5360 • (800) 869-9128

APPLICATIONS FOR NOISE-ATTENUATING HEADSETS



David Clark Company's VOX (voice-activated) System allows crane operators to keep both hands free to work the controls. They hear instructions the first time, avoiding costly errors.



A foreman's job depends on clear communication. Noise-Attenuating Headsets, with noise-canceling microphones, allows use of the radio, regardless of background noise.



The safety of many people depends on the pump operator's ability to hear and transmit messages clearly. David Clark Headsets make this possible.



The constant noise of the locomotive makes it very difficult to transmit and receive on the radio. Noise-Attenuating Headsets offer the perfect solution, combining hearing protection with clear communication.

For durability and reliability, David Clark Company **Noise-Attenuating Headsets** are the clear choice, regardless of your application. All headsets are tested and certified with a Noise Reduction Rating (NRR-24dB), as mandated by the EPA, and are backed by the best customer-service policy in the industry.

Headsets and adapters are available for all types of two-way radios, including:

- PTT (push-to-talk, with boom microphone)
- VOX (voice-activated, with boom microphone)
- VOX-TM (voice-activated, with throat microphone)

Also available: the Series 3800 Intercom System with mobile radio interface.

For all these reasons and more, call or write for complete information.

David Clark COMPANY
INCORPORATED

360 Franklin Street, P.O. Box 15054, Worcester, MA 01615-0054
TEL: (508) 756-6216; FAX: (508) 753-5827; TELEX: 920482



Visit Us
at IWCE,
Booths 713 & 715.

Fried green transistors

The benefit of having a system diagram at hand for a service call at oh-dark-thirty outweighs the time and trouble it takes to draw one during the installation or during the first non-emergency visit to a new customer.

By Mike Mekelburg

I arrived on the scene at 2 a.m.

It was an emergency after-hours call-out, the last of several that night for me. No one in the city had anticipated the extent of damage wreaked by a sudden sky-splitting thunder-

storm, and on-call service technicians were stretched to the limit, and beyond.

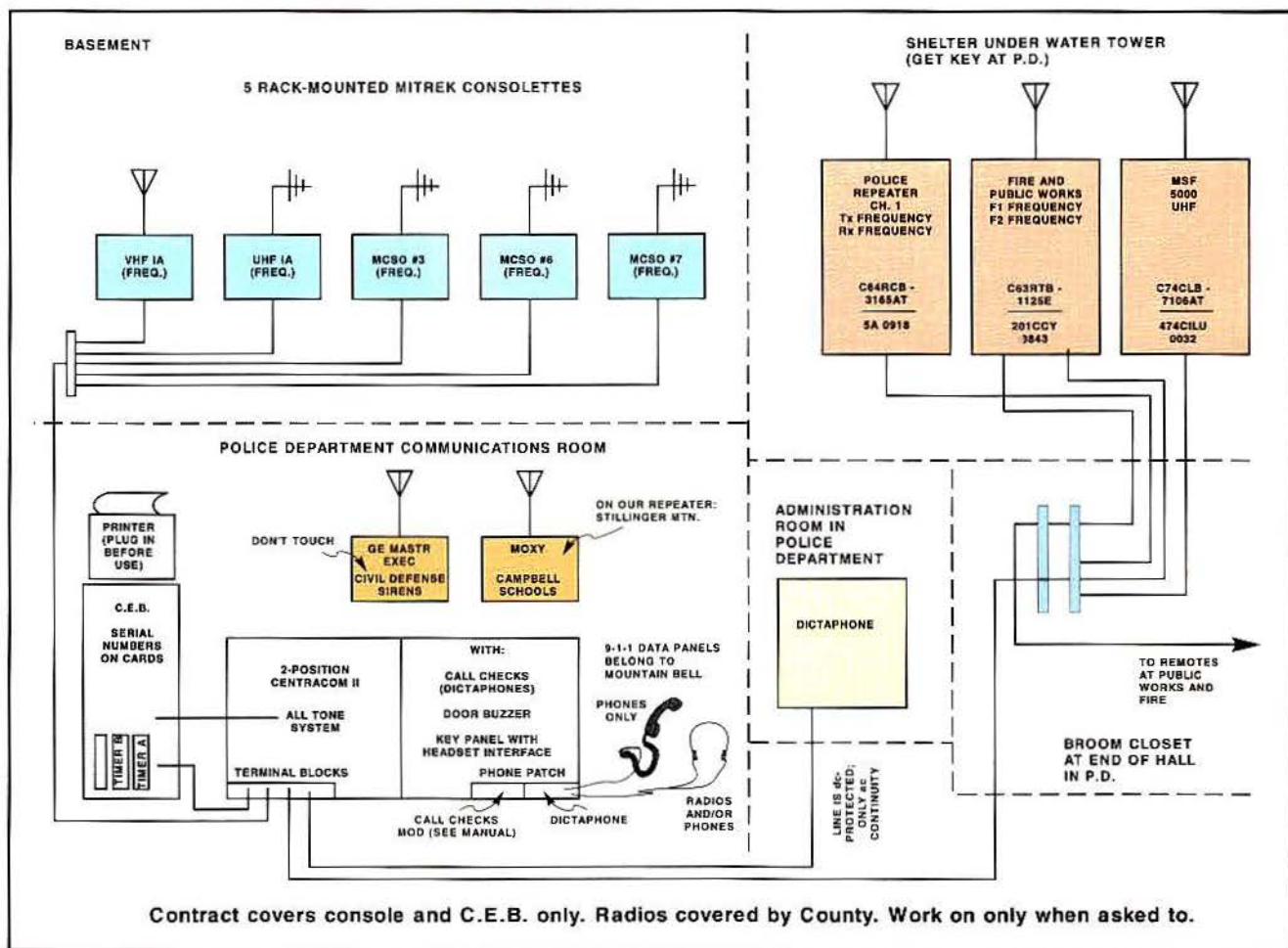
The contracted technician for the police communications center was knee-deep in smoking silicon halfway across town, so I was called out of desperation by a frazzled duty sergeant.

The station house was bathed in inky darkness as I parked my service van on

the quiet street. I walked to what looked to be a front door and rapped on the glass.

After several attempts, I used my penlight to peer inside the unfamiliar space. Frustration and fatigue drove

Mekelburg is lead technician at Confidential Communications Services, Flagstaff, AZ.



This is an example of a radio communications system diagram that can be helpful to keep on file in the service center and in the service vehicle for use when responding to a repair call after hours.

Why is Icom the Perfect Trunking Radio For Every LTR® Application?

The Answer is: Simple.



IC-U81T
1 & 2.5 Watts
Talk Around
Small
2.4"W x 6.3"H x 1.7"D

IC-U810T
15 Watts
Talk Around
Auto Shut Off
5.9"W x 2.1"H x 7.4"D

Only two 800 MHz trunking radios on the market today have all the features owner/operators need, *plus* the simple operation end users want.

ICOM makes both of them: the U81T portable and the U810T mobile.

SIMPLE FOR YOU, SIMPLE FOR THEM.

The easier a radio is to use, the easier it is to sell to an end user. That's the philosophy behind ICOM trunking radios. It's the reason behind features like the **alphanumeric display** that lets you see at a glance precisely who you're talking to.

SIMPLE TO LEARN.

The mobile and the portable function exactly the same way: if you can use one, you can use both. And no radio is simpler to learn! Users with limited requirements don't have to know about "systems" or "groups" — ICOM's unique **rotary dial access** lets anyone step through up to 20 settings until they see the one they want on the display. A short learning curve means fewer hassles for your subscribers, fewer headaches for you.

SIMPLE TO EXPAND.

Easy access doesn't mean limited capacity. With 20 systems by 10 groups, nobody else matches ICOM's 200-setting maximum capacity! Compatibility? Johnson LTR®, of course, plus AmeriCom for SMR operators that have chosen the next generation of networking technology.

SIMPLY THE BEST.

ICOM is one of the most respected names in communications technology. Before you commit to a new radio, check out ICOM. We've simply got more of what you and your subscribers want in a radio.

For Information Call
1-206-450-6088

ICOM America, Inc., 2380-116th Ave. N.E.
Bellevue, WA 98004
All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. U81593



ICOM

Simply the Best®

me to give the door a tug. It almost hit me in the nose.

"Hello," I called into the black hallway. No answer. Odd, I thought. I could waltz in and rip-off a police station, if so inclined.

The beam from my penlight landed on recognizable terrain. A single-position dispatch console came into view.

I lipped the penlight and set to work extracting a T/R module. What awaited was not for general viewing pleasure.

Spaced in an orderly fashion across a green CMOS-sensitive circuit board were cratered surface-mount chips and popped transistors. Random inspection of other boards proved similar results. A direct hit, no doubt, or very shoddy

protection.

A car engine idled in the distance.

I carefully made my way to the back of the eerily empty building and stepped into the night air. A lone squad car sat in the center of a fenced parking lot. The duty sergeant stood alongside the vehicle while a plainclothes dispatcher sat behind the wheel, using the mobile two-way as a makeshift comm center. Mercifully, he dealt with a department that has only 10 squads.

The sergeant spotted me and led the way back to the violated dispatch console. I needed information because it was my first time on the premises—and looked to my only source. I asked where the radio base was.

The officer waved his flashlight onto

Spaced in an orderly fashion across a green CMOS-sensitive circuit board were cratered surface-mount chips and popped transistors.

the apparatus before us. "You're looking at it," he said.

"No-no," I countered. "This is audio and dc control. There's copper from here to a transmitter-receiver box somewhere. And then coaxial cable to an antenna."

"Really? Well, the antenna is on the roof," he informed. "Bunch of 'em."

"And where do the cables lead to?"

"Phhf. Right here. Don't they?"

I rubbed the back of my neck and sighed. "OK. Where's your system diagram?"

"Excuse me?" he replied.

I explained what I meant.

"Oh," he said. "Never had one. Harry has worked here for 47 years—knows where everything's at. He's the building custodian. That's the guy you want."

"Where is Harry now?"

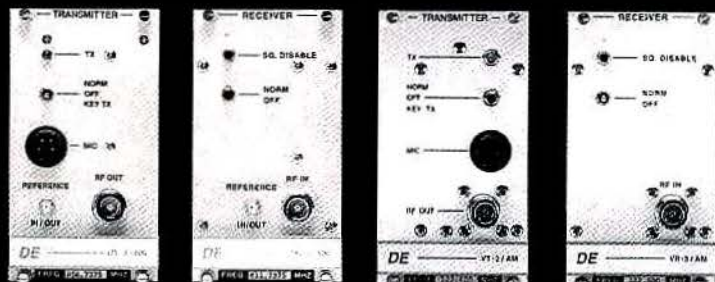
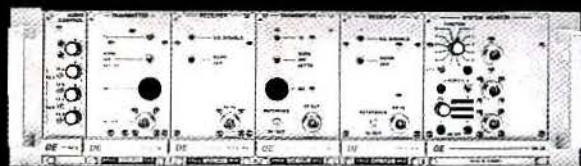
"Acapulco."

"I see." I scratched a temple. "Any chance of reaching him?"

"...We could page him," the sergeant offered.

THE PEAK PERFORMER

MT-3 SERIES MOUNTAIN-TOP REPEATER



New UHF (806-869 MHz Synthesized) and AM VHF (118-136 MHz)
Transmitter and Receiver pairs (FCC/DOC Approved)

THE ULTIMATE IN RUGGED AND DEPENDABLE
SOLAR POWERED REPEATER COMMUNICATIONS

USFS contract #54-3187-2-16 GSA # GSOOK 93AG S0647

Available in VHF and UHF (138-869 MHz) Combinations

DE DANIELS ELECTRONICS

43 Erie Street, Victoria, B.C., Canada V8V 1P8
Phone: 1-604-382-8268 Fax: 1-604-382-6139 (Canada)
Phone: 1-206-671-8046 (U.S.A.)

Circle (39) on Fast Fact Card

The New STABILOCK® 4015 Radio Test Set Tests Great—Less Weight

Under
\$13K/3 Year
Warranty

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

The STABILOCK 4015 packs a lot of features in a compact design:

- ☐ spectrum analyzer with audio
- ☐ electroluminescent display for easy viewing night or day
- ☐ licensed CLEAR CHANNEL LTR® testing capability
- ☐ memory cards to load and run tests automatically, including all cellular formats
- ☐ digital storage oscilloscope
- ☐ internal battery

Lighten your two-way test load today—call for more information on the STABILOCK 4015:
1-800-225-5765 (in MA: 508-671-9700).

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies

NEW OPTION



Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

EDACS™

Trunking Licensee

**Now in stock at Tessco
(410) 472-7000**

Quality Test Solutions Schlumberger Technologies

Schlumberger Instruments
P.O. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)



Schlumberger Technologies

Canadian Representative
Atelco Limited
9225 Leslie St. Unit 7
Richmond Hill, Ontario
L4B 3H6
Phone: 416-882-9455
Fax: 416-882-9454

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 378666
Fax-44 252 543854
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Gutenberg Str. 2-4
D-85 737 Ismaning
Germany
Phone-49 89996410
Fax-49 8999641160

Circle (40) on Fast Fact Card

He appeared puzzled when I told him I doubted that Acapulco was in pager range.

"Well I'll be dipped!" he exclaimed. "Next you're going to tell me that my car phone doesn't pick up its signal from nearby telephone lines!"

"I'll save that for another day," I said.

We made our way to the basement, shining our lights for signs of radio life as we went.

I picked up a coax bundle and followed it to a locked door. "Key," I said with my hand outstretched.

"Harry's got 'em," the sergeant responded. "Keeps them tied to a belt loop with aircraft cable. Harry's never lost them keys in 47 years."

I made it through the door with a 12-inch slotted by 3 a.m. Inside was an assortment of unlabeled equipment. The main police base was finally determined to be a unit made by Zlaxton, or something equally Greek. I searched the cabinet and surrounding area. No manuals. The sergeant shrugged.

"Get outta town," he quipped. "You mean you need a book to fix this stuff?"

I ended up rigging a battery charger to a car battery (in a ventilated area) and then to a spare mobile radio we

System diagrams are a handy reference for quick refamiliarization of customer equipment long unseen.

stumbled upon. A 20-foot jumper of RG-8 allowed the use of the rooftop antenna, and allowed the dispatcher to sit behind his grid-and-dispo board in the comm center.

The appropriate contracted technician could sort things out in the morning. I didn't want to steal all his fun.

The point of the story is to promote

the use of system diagrams. It may take a little extra time to draw one up either at installation or during the first non-emergency trip to a new customer—but the benefits of having one in a single oh-dark-thirty service call will far outweigh this.

A system diagram is a block-diagram drawing of a customer's fixed equipment. It generally is used only for customers with a wide array of equipment or numerous fixed sites or both. Rudimentary road maps and building floor plans may also be inserted into a system diagram. Typical entries include:

- ▶ equipment model and serial numbers.
- ▶ channel numbers and frequencies.
- ▶ customer's individualized unit designations.
- ▶ radio-tie line numbers.
- ▶ building numbers, room numbers, street addresses.
- ▶ customer contact names and phone numbers.
- ▶ door key locations and special access instructions.
- ▶ lists and locations of manuals and spare equipment.
- ▶ tone, dc or local classifications.
- ▶ emergency procedures.

The method I have found to work best is to equip each field technician with a book of all customer system diagrams, give one copy to primary customer contacts, and post a copy in a visible location near a customer's equipment.

I have used system diagrams repeatedly to isolate a "hidden" or forgotten remote that was loading down a system. System diagrams are a handy reference for quick refamiliarization of customer equipment long unseen.

And hey, they look professional. A customer having hard evidence that the shop looking out for his equipment is well organized won't be so eager to switch to another, and won't be so reluctant to mail in that monthly maintenance fee. It all works together.

On the way out I informed the sergeant that the front door to the station house was unlocked. "Better get Harry back here," I said. "Wouldn't want him to part with those keys."

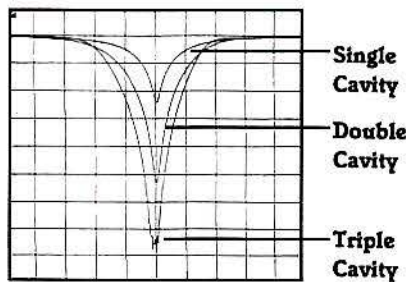


TUNABLE NOTCH FILTER

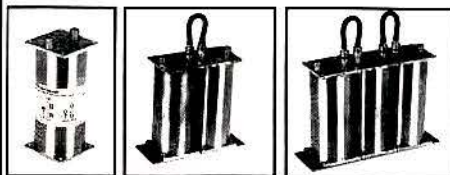
The 6367 series comprises 6 separate tunable notch filters, each of which covers an approximately 2:1 frequency range with adjustable 3 dB bandwidth. A coaxial or helical resonator is tuned with high Q air trimmers to produce a relatively deep notch at narrow bandwidth.* Available for tuning ranges of:

22 - 35 MHz
30 - 50 MHz
50 - 108 MHz
108 - 216 MHz
216 - 450 MHz
450 - 900 MHz

Ask for our NEW Mobile Phone Catalog MP/92!



Response of Single, Double and Triple Cavity assemblies adjusted to the same 3 dB bandwidth.



MICROWAVE FILTER COMPANY, INC.
6743 Kinne St. • E. Syracuse, NY 13057
800-448-1666 • 315-437-3953
FAX: 315-463-1467 • Telex: 249-613

SINCLAIR



Sinclair Radio Laboratories Inc.
675 Ensminger Road.
Tonawanda, N.Y. 14150
Tel: (716) 874-3682 or
(800) 288-2763
Fax: (716) 874-4007

Sinclabs SP Series of high performance power supplies are designed for reliability, long life, and freedom from failure.

All 8 Sinclabs certified power units are backed by a two-year limited warranty.

Full brochure and specs available. 

FOR THOSE WHO WANT DEPENDABLE POWER

Circle (42) on Fast Fact Card

IWCE/Fall preshow overview

Adapting with the growing mobile industry, the International Mobile Communications Expo/Fall show is emphasizing wireless and changing its name to the International Wireless Communications Expo/Fall (IWCE). This year's show will be held at the Philadelphia Convention Center, Philadelphia, Sept. 21-23, and it includes three days full of technology-oriented exhibits and seminars.

On Tuesday morning, Sept. 21, a free opening session and continental breakfast will feature a round table discussion by key executives about the converging technologies of wireless, voice and data.

The new chairman of the Federal Communications Commission (FCC) will address the IWCE attendees on Wednesday, Sept. 22, about regulation timetables, personal communications services (PCS) allocation and licensing, and wireless communications' future.

The seminars are divided into International Wireless, Regulatory, Technology and End User tracks.

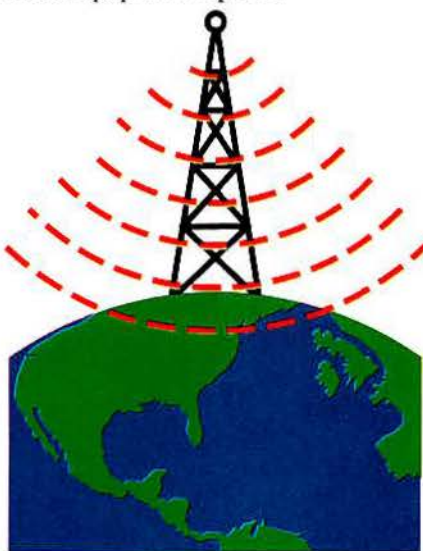
International Wireless topics include: "The North American Free Trade Agreement: An Update," "Mobile Communications Opportunities in the Americas," and updates on the Canadian and Mexican mobile communications techniques, planning and execution.

The Regulatory track includes round table discussions about the FCC and the Washington Regulatory scene and "The North American Free Trade Agreement: The Debate."

Persons attending the Technology track will learn about the opportunities for 220MHz, spread spectrum and digital SMR. Other topics include: "EMF Scare: The Truth Behind the Hype," "Test Equipment Tricks with Bruce Marcus," and "Networking the World of Wireless."

The End User track of seminars includes: "Mobile Data Equipment Update," "Mobile Data Networks," "Mo-

bile Data Applications," "Wireless Applications in Public Safety" and "Public Safety Mobile Communications Equipment Update."



More than 200 exhibiting companies will display products and services at the convention center. Mobile communications products on display include:

- ✓ mobile and portable radios
- ✓ cellular services and equipment
- ✓ mobile satellite services
- ✓ antennas
- ✓ paging equipment
- ✓ personal communications systems
- ✓ shelters
- ✓ test equipment
- ✓ tone signaling and control equipment
- ✓ towers, engineering and consulting services
- ✓ mobile data equipment
- ✓ batteries and accessory equipment.

Refer to the box below for a list of exhibit and seminar hours, as well as show information at a glance.

Mobile Radio Technology will be exhibiting in booth 437.



Event: International Wireless Communications Expo/Fall

Dates: Sept. 21-23

Location: Philadelphia Convention Center

City: Philadelphia

Number of Exhibitors: 200

Projected Attendance: More than 4,000

Exhibit Hours: Tuesday, Sept. 21, 11 a.m. to 6 p.m.

Wednesday, Sept. 22, 11 a.m. to 5 p.m.

Thursday, Sept. 23, 10 a.m. to 1 p.m.

Seminar Schedule: Tuesday, Sept. 21, 9 a.m. to 4:15 p.m.

Wednesday, Sept. 22, 9 a.m. to Noon, 2 to 4:45 p.m.

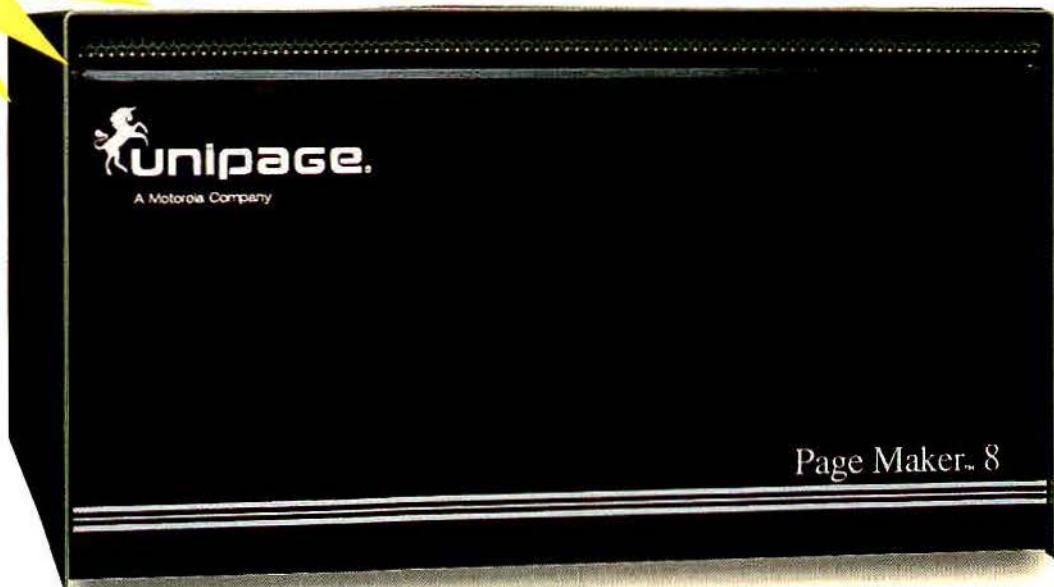
Thursday, Sept. 23, 10 a.m. to 1 p.m.

Registration/Hotel Information: 303-220-0600

NEW!

Sheer Genius

Page Maker™ 8



Big Terminal Features in a Small Paging Terminal

For Smaller Markets, Customer Owned Paging, Health Care or those Special Alpha Applications.

Unipage now offers those with smaller paging demands, a paging terminal that has many of the features normally found only on larger terminals. And it's affordably priced. Here are the standard features and some of the benefits that come with Page Maker 8.

Page Maker 8 Standard Features:

- 2000 Subscriber Number Capacity
- One Channel Output
- A Quad Store Card for Voice Paging
- A VP8 Card for Caller Prompting
- A Dual Trunk Card (two trunk inputs)

Profit from Big Terminal Features

- Use 2 Tone, 5 Tone, POCSAG 512, 1200 or 2400, GSC, NEC D3, NCA, or MBS pagers.
- Numeric, Alpha, Tone or Voice paging.
- Interfaces with PURC, Quintron and other transmitters.

A Few Benefits of Owning a Unipage

- Hot Card Maintenance--remove or install any card while the system is operational. It's convenient, and you don't have to power down and lose pages while the system is off the air.
- System is expandable to four trunks by adding an additional card. By adding other optional cards, your system can grow as your needs grow. And, all of the cards are transportable to an M15 chassis for future growth!
- Unipage is a Motorola company.

For more details, give us a call at the Unipage number listed below. We will be happy to show you how the Page Maker 8 is the wise choice for your paging needs.



unipage

A Motorola Company

1510 North Hampton Road
DeSoto, Texas 75115
(214) 228-5300

1-800-367-2864

FAX (214) 228-1430
Circle (43) on Fast Fact Card

Sold through Motorola Dealers or directly through Motorola and Unipage.

Mobile Communications Marketplace preview

Members of the paging, cellular, personal communications service (PCS) and conventional mobile telephony industries will convene Sept. 28-Oct. 1 at the Telocator-sponsored Mobile Communications Marketplace. More than 100 companies will display, demonstrate and explain their products and services, and a special section of the exhibit hall will be devoted to the display of new products.

Two simultaneous pre-convention seminars will lead off the educational side of the conference. They are on Tuesday, Sept. 28, and will inform attendees on RF exposure issues and PCS development. A special session titled "Today's Knowledge: Tomorrow's Success" will be on Wednesday, Sept. 29.

Panels, give-and-take round table discussions and the program of sessions cover a variety of topics, including paging opportunities, the secrets of selling, regulatory matters, consumer billing, the latest in PCS, how to get financing and ESMR vs. digital cellular.

John Clendenin, chairman and chief executive officer of BellSouth, will give the "State of the Industry" keynote address on Wednesday, Sept. 29.

Event: Mobile Communications Marketplace

Dates: Sept. 28-Oct. 1

Location: New Orleans Convention Center

City: New Orleans

Number of Exhibitors: More than 100

Exhibit Hours: Wednesday, Sept. 29—noon to 5 p.m.

Thursday, Sept. 30—noon to 5 p.m.

Friday, Oct. 1—8 a.m. to noon

Seminar Schedule: Tuesday, Sept. 28—8 a.m. to 5 p.m.

Wednesday, Sept. 29—9 a.m. to noon

Thursday, Sept. 30—8 a.m. to noon

Friday, Oct. 1—8 a.m. to noon

Registration/Hotel Information: 202-467-4770

Several special events are scheduled during the conference. The opening reception is on Wednesday, Sept. 29 from 5:30-7:30 p.m. The Chairman's dinner is at the New Orleans Hilton Riverside on Tuesday, Sept. 28 at 6:30 p.m. The dinner will honor current and past recipients of Telocator's Industry Awards and will commemorate the 10th anni-

versary of LifePage, Telocator's community service program.

For a complete rundown on sessions, dates and times, refer to the "Sessions" guide below and on page 54.

Copies of *MRT* may be found on exhibit in booths 845 and 847. Stop by and pick up a copy and sign up for a free subscription.

Sessions

DAY	TIME	TOPIC
Tuesday, Sept. 28	8 a.m.-5 p.m.	<i>Pre-Convention Seminars</i> Seminar I: RF Exposure Issues Seminar II: PCS Development
	6:30 p.m.	Awards Reception and Dinner
Wednesday, Sept. 29	9-10:30 a.m.	Opening General Session
	10:45 a.m.	<i>Special Session: Today's Knowledge: Tomorrow's Success</i>
	noon	Exhibits Grand Opening
	5:30-7:30 p.m.	Opening Reception



Fast. Responsive. Handles like a dream.

Wavetek designed the 3500A Cellular Test System for performance. Pure and simple.

Now it's easy to run a complete diagnostic test in seconds.

Exclusive icon prompts make it simple. The 3500A shows you exactly what to do from the moment it's turned on.

Whatever test function you want, just follow the pictures on the backlit LCD screen and push the large, soft keys. You're off and running.

Unique features such as "QUICK ID", comprehensive auto registration, "AUTOGRAPH", characterization of transmit power level,

and a friendly quick-alignment "MANUAL" mode are all standard. The automatic "GO/NO GO" mode is ideal for testing ready-to-ship units in seconds. And all test results can be printed out in an easy-to-read service record for your customer.

With all the competition for cellular business, Wavetek puts you ahead of the pack.

The 3500A makes your job faster, more precise, and more enjoyable. Call Wavetek for a test drive today. 1-800-245-6356.



Mobile Communications Marketplace

DAY	TIME	TOPIC
Thursday, Sept. 30	8-9 a.m.	<i>Early-bird Sessions</i>
		Tax Policies in the Clinton Era: What They Mean To You
		Compliance From "A" To "Z"
		Secrets of Selling
		Alpha Paging Opportunities
		Billions of Beepers: Red, White and Blue
		PCS Service Descriptions
	9-10:30 a.m.	<i>Concurrent Session I</i>
		Moving From Customer Service To Customer Care
		Trends of the 1990s: Consolidation
		Latest News on PCS Technology
		Cutting a Deal for Spectrum With Broadcasters: A Desirable Option
		Promoting Positive Images of Mobile Communications
	10:45 a.m.-noon	<i>Concurrent Session II</i>
		FCC Issues and Answers
		Trends of the 1990s: Diversification
		Innovations in Retail Paging
		Advanced Messaging Update
		Changing Ideas About Consumer Billing
		The PCS Link Between Computers and Communications
Friday, Oct. 1	8-9 a.m.	<i>Concurrent Session III</i>
		Advanced Media Relations: Maximizing Media Coverage
		ESMR vs. Digital Cellular
		Making Effective Advertising Decisions
		International Issues and Standards for PCS
		The Power of Strategic Planning in Your Success
	9-10:30 a.m.	<i>Concurrent Session IV</i>
		Selling To New Market Segments
		How To Deal With Difficult People
		How To Get Financing
		The "New" Rules Part 22
		PCS Gurus Predict Its Performance
	10:45 a.m.-noon	<i>Concurrent Session V</i>
		Productivity = People Power
		How Paging Can Profit from the Wireless Data Revolution
		Educating the Financial Community
		Update: FCC Report and Order on PCS

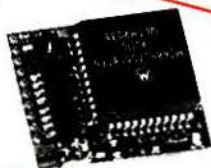


4 New Winners from Midian

\$5995



Model ANI-U



Smallest Multi-Format, Multi Feature ANI with optional CTCSS encode

- ANIs: DTMF, CCIR, ZVEI, DZVEI, DDZVEI, NATEL, EEA, EIA, & MODAT*
- Optional 51 code CTCSS encoder
- Delayed CTCSS for inaudible ANI
- User-programmable tone timings
- Leading and/or Trailing ANI with mic mute
- Programmable ANI repeat delay timer
- Emergency ANI with repeat timer
- Emergency ANI "man down" delay timer
- Programmable ANI speed & front porch delay
- Programmable Busy Lockout
- Timeout Timer with stuck mic alert tone
- Available for Midian Zap™ & GE-Star® digital ANI formats (DFA-1/DFA-2)
- Dimensions: 1.1" x .88" x .22"



Model RT-8X/TRA



RTX-compatible Telephone to Radio Adapter

- Converts standard telephone with RJ11 connector to radiotelephone formats, rural phone, or extended phones when interfaced with simplex or duplex radio
- Full/Half-duplex or VOX capability
- Outputs 90 Volts to ring standard telephone bell
- Built-in dial and busy tones
- Programmable via telephone Touch Tone® keypad
- 1-12 digit connect and disconnect ANI
- 10 number memory dialer with last number redial
- Also available for DTMF interconnect applications

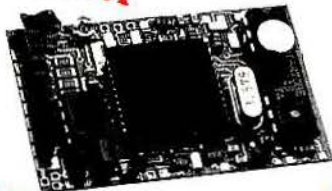
\$26995

Ready
to
Deal?

\$9995



Model RT-8X



Programmable DTMF Encoder/Decoder Compatible with RTX

- Three programmable decode numbers for selective calling with multiple ring codes
- 1-12 digit connect and disconnect ANI
- Ten number memory dial, last number redial
- Call routing digit for CES or RTX mobile call
- Trunking delay for connect ANI
- Time Out Timer & Busy Channel Lockout
- Carrier refresh for base or repeater COR/COS modulation
- CTCSS encoder with programmable
- Deadbeat Disable for lost or stolen radios
- Programmable channel scanning
- Timed automatic disconnect
- Forced decode reset
- Dimensions: 1.84" x 1.2" x .25"



Model ID-1



Keyboard Programmable Morse Identifier

- All messages & features programmable via 12-button Touch Tone®-style keypad with alphanumeric characters
- Sends 16-character station ID or 130-character message at programmable repeat intervals and speed
- Programmable front porch keyup delay
- Programmable morse tone freq. (1 to 3000 Hz)
- Programmable wait time after COR loss
- Can send morse tone manually
- Dimensions: 1.4" x 1.1" x .25"

\$7995

To Order Call Toll Free: 1-800-MIDIAN'S

Corporate Headquarters: (602) 884-7981 FAX: (602) 884-0422

MIDIAN

World Leader in Innovative Communications Technology

MIDIAN ELECTRONICS, INC. / 2302 East 22nd Street / Tucson, Arizona 85713

Technically speaking

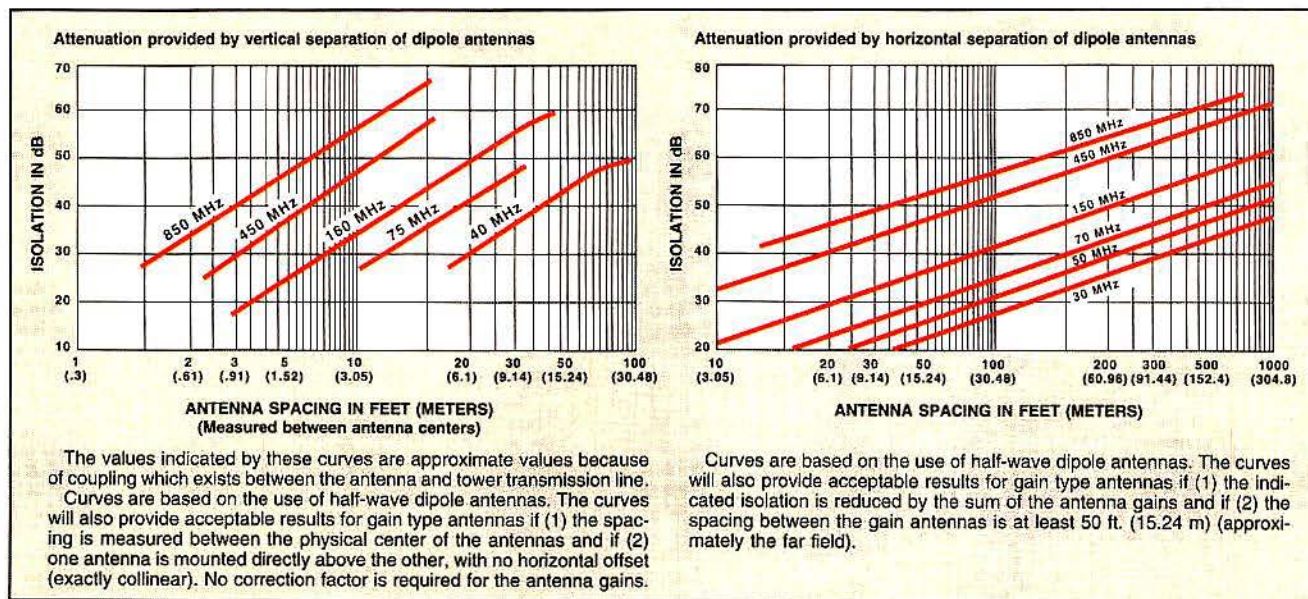


Figure 2. These graphs can be used to approximate the amount of isolation provided by vertical (left) or horizontal (right) separation of antennas. (Courtesy of Decibel Products.)

(continued from page 8)

loss and any filter losses must be taken into account to calculate the receiver

input signal level. Let's say the line loss is 2dB and no filters are used.

► *Calculating the noise signal level:*

Now we have enough information to

arrive at a fairly good approximation of the level of the transmitter noise component (on the receiver frequency) at the receiver's input. (See Figure 3

Keep In Touch with ACCESS™

Color Touchscreen Consoles from Avtec



ACCESS™ - Advanced Concept Communications Exchange & Signaling System for Utilities, Airlines, Gas & Oil Companies and Public Safety - A fully integrated, non-blocking, radio/telephone console system using color touchscreen technology. Touch control, pioneered by Avtec for high capacity voice communications systems, is fast becoming the new standard for dispatch consoles.

Avtec is a licensee of the ERICSSON GE MOBILE COMMUNICATIONS EDACS™ trunking system

Call or write today -
AVTEC, INC.

4335 Augusta Hwy. • Gilbert, SC 29054 USA
(803) 892-2181 • FAX (803) 892-3715

Have all those 2-Way Radio promises gone up in smoke?



Know who you're working with.

When I'm answering an alarm, I can't afford to have any doubts about my equipment. That's why I rely on my Kenwood 2-way radio and my "Team 2-Way" dealer to come through for me when the heat is on. They work with me to make sure I have a radio that meets the unique challenges of my job. Just like my Kenwood radio, my "Team 2-Way" dealer is there for me when I need it most. And that's a promise that comes through loud and clear.

The **TK-630, 730, 830 Series mobiles** can be customized for many applications, including dual band and dual head configurations. And unlike other radios requiring expensive add-ons, the TK-630, 730, 830 Series come with these standard features:

- Built-in Public Address
- Backlit LCD and Buttons
- Assignable Buttons
- 12 Character Alphanumeric Capability
- Single or Dual Priority Scan
- Speaker Control
- Talk Around
- and many others...

The **TK-230SP and 330SP portables** have been engineered to sustain the most rigorous demands of the public safety professional. These advanced generation VHF/UHF synthesized portables are produced with a rigid adherence to the highest quality control standards, and come with these standard features:

- Microprocessor Controlled Scan
- Synthesized 100-Channel Capability
- Alphanumeric, Multi-function LCD Display
- Built-in QT and Digital QT
- Five-Watt RF Output
- MIL-STD 810 Approved
- Wide Band Channel Frequency Spread

**We want
you
on our
team!**

FREE SPORT CAP WITH
DEALER DEMONSTRATION*
Call 800-950-5005
For a Dealer Nearest You

*While supplies last



TEAM 2 WAY™
KENWOOD

Circle (49) on Fast Fact Card

Technically speaking

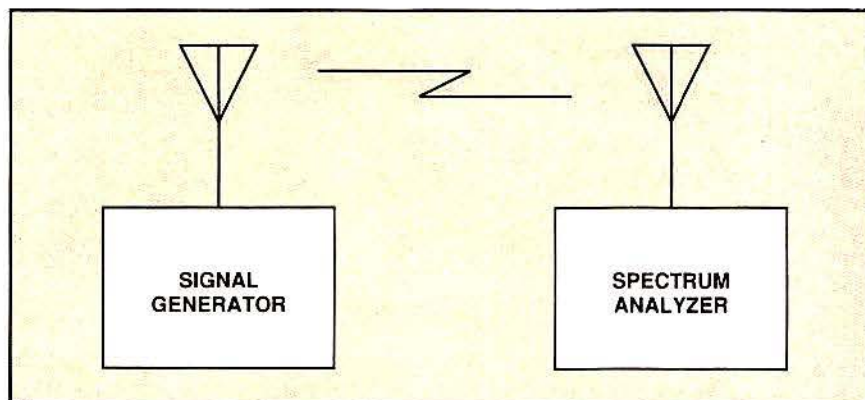


Figure 5. This simple setup can be used to determine existing isolation between two antennas with better precision than the graphs might provide. Feed a 0dBm signal into one antenna and measure the dBm level at the other antenna with a spectrum analyzer. The spectrum analyzer display level equals the isolation between the two points. If the spectrum analyzer display is at the -50dBm level, then the isolation is 50dB.

model transmitter with reduced side-band noise level. The manufacturer's graph of transmitter noise vs. frequency shows that, at a frequency 225kHz removed from the carrier, the noise level is down -102dBc (dB below carrier). This level represents a considerable improvement compared

to the -63dBc noise component level used in the example for Figure 1A.

Another improvement results from mounting antennas with vertical, rather than horizontal, separation. Notice from Figure 2A (160MHz) that the antenna isolation is approximately 50dB for 20 feet of vertical separation.

Furthermore, it is not necessary to deduct the sum of the antenna gains from the isolation figure on the graph as it was for horizontal separation. This difference alone gives an additional 12dB of isolation.

Now let's recalculate the level of the offending transmitter noise component. (See Figure 4 on page 58.)

With the different antenna arrangement and the higher-quality transmitter, the offending transmitter noise component has been reduced to -106dBm, only 20dB above the required level. The remaining 20dB of attenuation can be obtained with a single notch cavity on the transmitter tuned to 159.120MHz.

► Measuring antenna isolation:

If the antennas are already installed you can measure the exact isolation between the two antennas by using the equipment setup shown in Figure 5.

First, set the signal generator to 0dBm and, with the generator connected directly to the spectrum analyzer, make sure the spectrum analyzer

BIRD™ WATTMETERS, ELEMENTS, ATTENUATORS AND LOADS

We earned our position as the leading Bird distributor with a big inventory, good prices, quick delivery and service. We would like to earn your business... please call today.



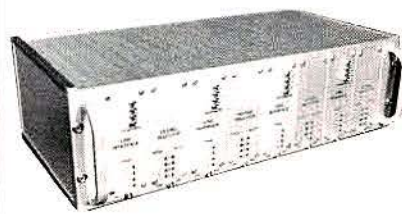
2050 S. Bundy Drive
Los Angeles CA 90025
Toll Free: 1-800-877-7979
Or: 1-310-820-1234
FAX: 1-310-826-7790



ALSO IN STOCK:

AEA DATA
AOR
ASTRON
BECKMAN
CENTURIAN
CUSHCRAFT
FANON
HENRY
HOXAN
ICOM
JABRO
KANTRONICS
LARSEN
MAXON
OPTO
PIPO
RADIUS
TEMPO
UNIDEN
YAESU

SIGNAL-TO-NOISE Voting Comparator



Improve coverage by adding receivers

- Expandable to 32 Channels
- Continuous Voting
- 19" Rack Mountable
- Select/Disable Switches for Manual Override
- Can be used with RF Links or Dedicated Lines
- LED Indicators
- Hundreds in Service
- More

— Competitively Priced —

For more information call or write:

Doug Hall Electronics
Voter Dept.
815 E. Hudson St.
Columbus, Ohio 43211
(614) 261-8871

Circle (50) on Fast Fact Card

Circle (51) on Fast Fact Card

Catch the winning spirit.

From the forge of world-wide competition comes the new Hustler *Spirit* series of vertical antennas.

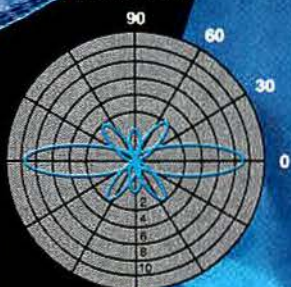
Designed to win the race to provide the highest performance and durability possible, at a price that leaves others in the dust.

If you are driven to achieve a superior signal; if you need an antenna which is virtually impervious to wind and weather; if you want the best the world has to offer, catch our new *Spirit*-and win today.

Model Shown: HS9-45070

Also Available: Models from 136 MHz. to 2 GHz, including Land Mobile, Cellular, Trunking, SMR, Paging and PCN. All models available in a variety of gain configurations.

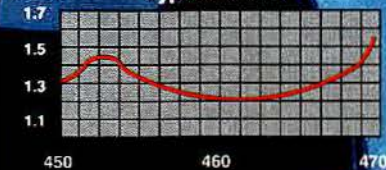
Radiation Pattern
(Relative Field)



Vertical

(0.5 Below Horizontal)

VSWR Typical VSWR



Gain (Relative to 1/2 Dipole)



Beyond your Expectations

One Newtronics Place
Mineral Wells, Texas 76067
1-800-949-9490 • (817) 325-1386

YES, I'm interested in the new *Spirit*.
Please send me your latest Professional
Products catalog.

Name

Company

Address

City State Zip

Circle (52) on Fast Fact Card

Telewave's Broadband RF Wattmeter is rapidly becoming a new Industry Standard!



We're Crushing the Competition!



Telewave, Inc.



Circle (53) on Fast Fact Card

Technically speaking

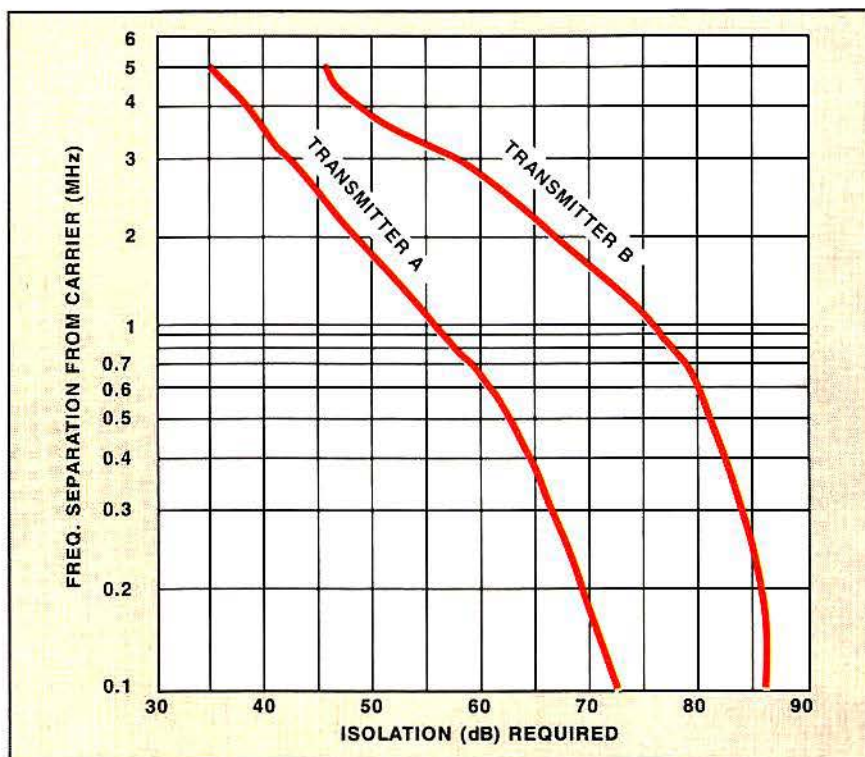


Figure 6: This graph shows that all transmitters are not created equal. It indicates the amount of isolation required between the transmitter (operating at 100W or +50dBm) and the receiver (with a sensitivity of 0.35 μ V at 12dB SINAD). Notice that transmitter A requires much less isolation to prevent interference to the desired receiver signal than does transmitter B. This is because transmitter A produces less sideband noise than transmitter B, that is, transmitter A is cleaner. Remember, the required isolation indicated by the graph is the entire attenuation between the transmitter output and the receiver input—line losses, filter losses, isolator loss and antenna isolation.

display reads 0dBm. Then connect the signal generator to one antenna and the spectrum analyzer to the other antenna.

Feed a 0dBm signal from the generator to the antenna and measure the signal level on the spectrum analyzer at the other antenna. This step is simple if the transmitter and receiver are in the same building (antennas on same tower).

► Transmitter isolation requirements:

The graph in Figure 6 above illustrates the difference between the transmitter sideband noise suppression of two different transmitters. These two curves are based on the isolation required to prevent sideband noise from interfering with a receiver with a sensitivity rating of 0.35 μ V at 12dB SINAD. These curves are not imaginary, but were derived from actual equipment specifications from two popular radio manufacturers.

To compare the two transmitters, the

curve for transmitter A shows that, at 200kHz spacing between transmitter and receiver frequencies, approximately 69dB of isolation is required between the transmitter output and receiver input. For transmitter B at 200kHz, approximately 85dB of isolation is required.

These isolation figures include line losses, antenna isolation, filter losses and any other passive loss—in short, every attenuation between the transmitter output and the receiver input.

When selecting equipment for use at high-density sites, compare the specifications carefully. Be sure to ask the manufacturer for data on receiver desense and transmitter noise before making a decision.

You might get a lower price on the initial purchase of lower-quality equipment, but you may end up paying more for expensive filters. The net difference in green might put you in the red.



PERFORMANCE YOU CAN TRUST...



BATTERY AFTER BATTERY AFTER BATTE



RY AFTER BATTERY AFTER BATTERY AFT



ER BATTERY AFTER BATTERY AFTER BA

JBRO...YOUR SMART CHOICE FOR QUALITY RECHARGEABLE BATTERIES.

Dependable communication is critical. Dependable batteries guarantee it. That's why more and more mobile communications operators everywhere are relying on the consistent quality and outstanding performance of JBRO rechargeable batteries.

Uncompromising workmanship and an extensive line ensure you'll get maximum power and a perfect fit

for your specific application. Call today for our FREE catalog of highest quality battery products and services. Battery after battery, JBRO gives you performance you can trust!

JBRO

BATTERIES INC.



Maximize performance and life of your rechargables with JBRO's line of Telepower® Conditioner/Analyzers.

JBRO Batteries, Inc. 1938-A University Lane Lisle, IL 60532-2150 Phone: 708/964-9358 Fax: 708/964-9081 Order Entry: 800/323-3779 Fax Entry: 800/237-6435
JBRO Batteries S.W., Inc. 25700 1-45 North #111 Spring, TX 77386 Phone: 713/367-9393 Fax: 713/292-7139 Order Entry: 800/245-1138

Circle (54) on Fast Fact Card

Mtel receives first FCC Pioneer's Preference

The FCC has granted Mobile Telecommunication Technologies (Mtel) the first final Pioneer's Preference for a two-way personal communications system (PCS) in the United States. The FCC has allocated 11 channels for nationwide PCS use and has assigned one of these to Mtel, which plans to file a formal license application for authority to construct the system as

soon as permitted by FCC rules.

The FCC decision assigns 50kHz of radio spectrum in the 930MHz band for Mtel to build a two-way wireless network called Nationwide Wireless Network (NWN). The system will allow people to send and receive wireless messages using laptops, palmtops and hand-held messaging units called personal digital assistants (PDAs),

which are being developed by the computer industry. NWN will also use acknowledgement messengers or pocket-size devices capable of returning confirmations of message receipt to senders.

Upon final licensing, NWN will operate in at least the top 300 U.S. markets by 1995. It is a location-independent system, meaning that messages can be sent and received without the need to know the city in which the other party is located. The network will consist of more than 3,000 base station receivers and transmitters, blanketing metropolitan areas and eliminating the need for users to notify the network with roaming instructions.

MobileComm tests high speed paging protocol

MobileComm, Jackson, MS, will begin testing the new Flex high speed paging protocol technology from Motorola, Schaumburg, IL. The technology will allow numeric and alphanumeric messages and data transference to be sent at 6,400 bps.

The technology will increase the number of users per radio frequency, improve battery life in wireless devices and help expand wireless service offerings such as electronic mail; information services; the updating of personal calendars to pagers; and personal organizers, portable computers or personal digital assistants (PDAs).

Ram Mobile Data completes phase I of network expansion

Ram Mobile Data, New York, has installed the 840th and final base station in its phase I network buildout, fulfilling its pledge to provide wireless data service to more than 90% of the nation's urban business population by the end of June 1993.

The two-way shared wireless data service infrastructure was built from the ground up. Ram's networks provide coverage to more than 6,000 cities in 210 metropolitan areas in the United States, compared to 50 metropolitan areas a year ago.

Hark's board comes out on top in field tests

Field tests conducted by Hark Systems, Summerville, SC, and Motorola, Schaumburg, IL, show an improvement in audio quality when the standard TRIB board was replaced by the Hark TRAC board, which was developed specifically for Motorola to enhance the audio quality when using the standard centralized interconnect. When the standard board was replaced, data and fax transmission occurred at a higher baud rate with fewer errors.



Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dBm)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	\$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	\$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	\$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	\$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	\$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar	\$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar	\$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	\$119.95
Inline (rf switched)						
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	\$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	\$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar	\$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar	\$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	\$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP348A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N Improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or Inline preamplifier today and start hearing like never before!

**Advanced
Receiver
Research**

Box 1242 • Burlington, CT 06013 • 203 582-9409



Circle (55) on Fast Fact Card

When every second counts...



TDM-150: Our state-of-the-art, 120+ channel console

Count on the reliability and performance of communications consoles from Orbacom

In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbacom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbacom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-

division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



Mini-TDM-150 Desktop Console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbacom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455
 and let Orbacom solve your
 dispatching problems. Orbacom
 Systems, Inc., 1704 Taylors Lane,
 Cinnaminson, NJ 08077;
 FAX: (609) 829-6980.



**ORBACOM
 SYSTEMS, INC.**

Circle (56) on Fast Fact Card

New Hampshire police, Motorola install digital FM two-way system

The New Hampshire state police and Motorola, Schaumburg, IL, have installed Phase Two of the first public safety digital narrowband FM two-way communication system. The system includes 100 Motorola Astro mobile and portable radios, Centracom series II Plus consoles and a four-site voting system.

Phase Two provides coverage in two counties in the southeast portion of the state, but the long-range plan is to convert

the statewide communication system to the digital capability. The system will accommodate the public safety digital communications standards, known as Project 25, established by the Associated Public-Safety Communications Officers (APCO). The standard will include provisions for a common air interface (CAI), trunking, encryption, data and inter-system signaling; although, only the CAI portion has been finalized.

IBM selects Dataradio as business partner for public safety market

Dataradio, Atlanta, has been selected by IBM, Tulsa, OK, to provide mobile data systems to the public safety market. The IBM Business Partner program has been in existence for more than 10 years and provides the company with selected application software and hardware offerings that provide system solutions for customers.

IBM chose Dataradio and its Vehicular Information Series (VIS) product line after completing a comprehensive study of available technology.

Legge, other investors acquire CES

The assets, operations and future business of Communications Electronics Specialties, Winter Park, FL, have been acquired by CES Acquisition. CES Acquisition is owned by eight individual investors led by CES president Richard C. Legge Jr., who owns a controlling interest in CES Acquisition.

Legge joined CES in 1985 and was promoted to president in 1988. He is chairman and president of the new company.

CES will continue to operate from its Winter Park facility.

First commercial 220MHz radio system placed in operation

The first commercial, five-channel trunked 220MHz radio system is operating in Houston. The system is equipped with mobile and repeater products from SEA, Mountlake Terrace, WA, and will be managed by Repeater Communications.

The Houston system is the first of several 220MHz trunked radio systems planned for construction and operation by NNC, a consortium of 220MHz license holders, select SMR operators, private investors and SEA. Among the cities where other NNC 220MHz systems will be constructed are San Francisco, Dallas, Chicago, New York, Atlanta, Denver and Los Angeles.

Glenayre licensed to provide high speed protocol

Glenayre, Duluth, GA, has been licensed by Motorola, Schaumburg, IL, to manufacture equipment compatible with Motorola's new Flex high speed paging protocol. Glenayre plans to incorporate the technology into new and existing products in 1993.



BATTERY PROBLEMS??

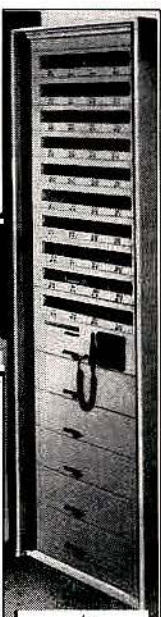
Our customers agree that the RAMSystem is the most effective ANALYZER on the market!



BATTERY PRO

Call before you invest ...

BatteryPRO Centres Inc.
P.O. Box 160
Black Diamond,
AB Canada
TOL OH0



In North America call
1-800-661-9401
or Fax
(403) 933-3233

Circle (57) on Fast Fact Card

OUR COMPLEMENTS TO YOUR RADIO

OUR complete line of accessories enables use of portable or mobile radios in virtually any situation. We have extensive experience in solving communication problems — from the routine to the extremely difficult ... and it's all available to you. Simply contact us.

SOUND IDEAS FROM
Setcom
CORPORATION

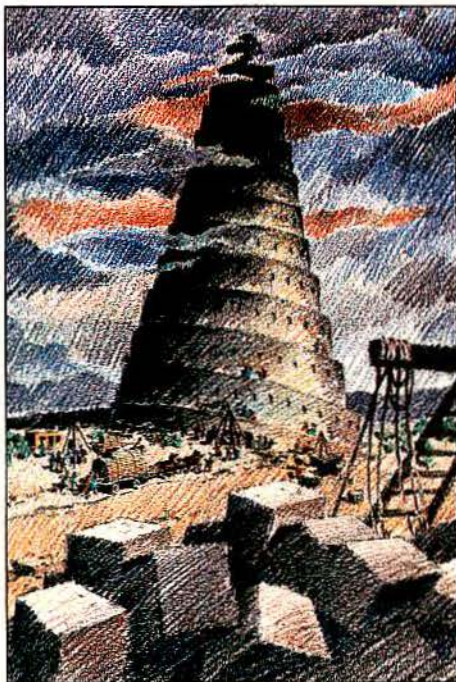
1400 Stierlin Road
Mountain View, CA 94043
415/965-8020

Circle (58) on Fast Fact Card

**WHEN YOU'RE BUILDING SOMETHING,
IT'S IMPORTANT FOR EVERYBODY
TO BE SPEAKING THE SAME LANGUAGE.**

It's particularly important in a situation where the various components of a project need to be integrated to work together — like the development of a telecommunications system, for example. Otherwise, efficiencies can be lost, standards compromised and dollars wasted.

That's why at LeBLANC, we've put together a fully integrated group of companies with the skills and experience to manage any job, regardless of size or complexity. It's why every project team includes



our technical service people working with our design engineers from Day One. It's also why we use our own full-time installation crews exclusively on every job.

So whether you need integration and optimization of additional components into an existing system, or

design, installation and maintenance of a totally new communications network, call LeBLANC.

**IT'S ONE WAY TO BE SURE THAT NOTHING
WILL BE LOST IN THE TRANSLATION.**



L & R Communications, Limited
LeBLANC Communications Inc.
(800) 831-0974

Members of the  LeBLANC Group of Companies

Lesson No. 1: Follow the money

By Robert H. Schwaninger Jr.

I've been writing this column for about six months, and it occurred to me that I haven't provided you with my handy-dandy, never-fail method of tracking regulation.

With a few simple tips, you too can start to find the path of logic that winds mysteriously among the jungle of special and government interests. It all starts with Lesson No. 1: Follow The Money.

Grab your pith helmet and butterfly net, and follow me! Mind you, it isn't always easy. Sometimes the wilder (and richer) animals can eat you alive when you are on a special interest safari, especially if your business is the bait. But maybe if you are able to analyze what's going on, you will be less vulnerable to attack.

Let's start with a simple case.

A two-way dealer gets a chance at a new customer who wants to buy 25 new radios to operate on a pretty clean frequency. The first thing the dealer is going to do is to sell the radios with the best performance and the biggest profit margin. See? Simple. The transaction all makes sense if you *follow the money*.

Frequency coordination

The dealer calls NABER* to find a fre-

quency and is recommended one that is fairly good, so the dealer decides to license it in his name rather than the customer's name. The dealer figures he might be able to load a few more users onto it. The dealer is acting in his economic self-interest when he gets a *private carrier license*.

*The question is, how
can Congress make
megabucks out of
megahertz and not rock
the re-election boat?*

NABER is acting in its self-interest when it charges the dealer a premium for private carrier status. This value-added transaction makes sense if you *follow the money*.

NABER is able to recommend that fre-

*NABER is the National Association of Business and Educational Radio, an Arlington, VA-based trade association that coordinates frequencies for the Business Radio Service.

quency because it is a certified frequency coordinator. The FCC, the federal agency that used to coordinate frequencies for free and lost its shirt doing it, certified NABER, among others, to do the job on a more-or-less exclusive basis.

That way the coordinators could make a dollar and the FCC wouldn't have to spend any more money doing pedestrian things such as frequency coordination. Its time would be better spent deciding such issues as whether rats can get cancer from RF energy emitted by electrical lighting dimmer switches.

The frequency coordination system saved the FCC a bundle. Thousands of hours that previously were devoted to coordinating frequencies were made available to unspool the point-to-point microwave applications, to process lottery applications from the application mills and to write speeches to Congress about spectrum auctions—another money-maker.

Free labor—dealer pays

The best part of it is that the FCC gets all this free labor from the frequency coordinators and the dealer pays for it. This arrangement explains why the FCC has been one of the frequency coordination system's biggest fans, if you remember Lesson No. 1.

When the FCC found that there was some slack left after farming out the frequency coordination duties, the question arose regarding what to do with this available, albeit limited, manpower.

The agency could have stepped up its efforts in enforcement, but there's no money in that. The fines are too low, the cost is too high and the forfeitures just get dumped into the U.S. Treasury. Besides, every time the FCC levies a really big fine, it's against a really big company with really noisy lobbyists on Capitol Hill.

Where Congress comes in

That brings us to Congress.

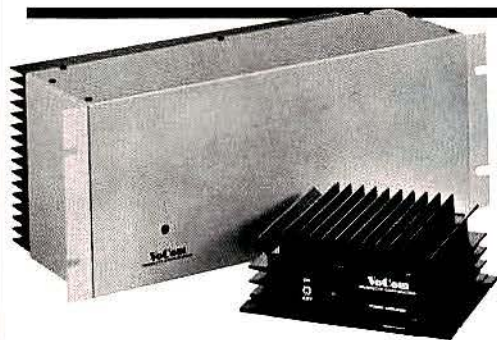
Congress has decided that the FCC can make money. It's got something that everyone wants: radio spectrum. The question is, how can Congress make megabucks out of megahertz and not rock the re-election boat?

Simple.

First, install filing fees. They look somewhat neutral, and they don't cost anyone too much.

Schwaninger, MRT's regulatory consultant, is a partner in the law firm of Brown and Schwaninger, Washington, DC.

BIG or SMALL We Have It All!



VoCom / RF Corporation

Quality since 1979

1-800-USA-MADE

(1-800-872-6233)

FAX 708/924-9078

POWER AMPLIFIERS FOR ALL INPUT LEVELS

- VHF Low Band to 300 watts
- VHF High Band (140-200 MHz) to 500 watts
- UHF Low Band (400-550MHz) to 350 watts
- UHF High Band (800-960MHz) to 140 watts
- True continuous rating at high ambient temperatures
- FCC type accepted

Circle (60) on Fast Fact Card

"UN-Conventional" Radios from **maxon®!**

What's "*un-conventional*" about Maxon's new 800 MHz transceiver? This exciting portable is priced **LOWER** than our competition's "*dispatch only*" models — without sacrifice to quality or features...

Introducing the TP-4800 Trunking Portable.

The TP-4800 is LTR® compatible, offers a variety of scanning modes, automatic free system ringback and full telephone interconnect. Quick system access and increased range enhance the overall value of the radio.

Features include a backlit alpha-numeric LCD display, dual-function keypad (user friendly *and* compact) and phone mode with "one touch" send and ringback for user convenience. A die-cast aluminum cabinet protects the radio under tough working conditions, assuring years of dependable service.

High quality... Low Cost. *The TP-4800 from Maxon.*

This "*un-conventional*" portable comes with Maxon's "*conventional*" commitment to satisfaction. Call us today for more information on the new TP-4800 or any product in our line of quality, cost-effective communications equipment.

maxon®

A World of Communications

Business Radio Division

10828 NW Air World Drive • Kansas City, Missouri 64153

1-800/821-7848, ext. 606 • Fax: 816/891-8815

LTR is a registered tradename of E.F. Johnson Company

Circle (61) on Fast Fact Card



Regulating technology

Second, increase the level of fines. If the FCC isn't going to enforce its rules very often, it might as well make a good return when it does.

Third, talk about user fees. Again, it sounds neutral, and most licensees would go along.

Finally, start the ball rolling on spectrum auctions, the alluring mother lode of payouts for the federal government that might result in gazillions of dollars pouring into the U.S. Treasury.

Problems

Wait.

There's a problem.

If Congress auctions spectrum for broadcasting, the broadcast media will bury them alive in bad press. That could affect campaign contributions.

Okay, give broadcasters an exemption based on say, the First Amendment. Sounds noble, although no one really knows what the heck Freedom of the Press and Freedom of Speech has to do with the entire discussion. But, no matter. Sounds good, particularly to the broadcasters.

Wait.

There's another problem.

Local politicians are the ones who rally the Elks and the Optimists and the Ladies Auxiliary to throw those campaign bashes that mean money and votes for members of Congress. Better give local governments a break, too.

All right. The stage is set for auction authority. Now all Congress needs is a little spectrum to sell and the lucre can start rolling in. So, where do they look?

Federal government spectrum

How about all those megahertz being used by the federal government for who-knows-what, and they aren't telling (national security, you know). Actually, they probably do tell Congress, but the information is contained in one of those thick, multi-volume reports sent over by the NTIA**, and Congressmen haven't the time to wade through it.

The important thing is that no one will ever sit down and figure out how much the spectrum will cost the federal government in lost resources. Instead, the only number

**NTIA is the National Telecommunications and Information Administration, a federal agency that administers radio spectrum allocated for federal government use.

that will be bantered about will be how much money the auctions might make.

There's only one little hitch in the scheme.

Congress doesn't want this to look like a giveaway to the largest operators. They have to do something, create some legislation, that will enable the small or minority operator to participate in the lottery.

But if they do that, Congress might reduce the amount of money to be made on the auctions. They might also be forced to wait for their money as smaller entities pay over time. And where do they draw the line between small operators and big ones? In short, they're stuck.

Passing the buck

But Congress is never really stuck. They will simply pass a bill that speaks in terms of preserving the rights of small and minority operators and leave it up to the FCC to figure out how the system might work. The FCC will be stuck.

That is, unless the FCC creates some independent, certified group to solve the problem for them by creating industry consensus through panel discussions, round table meetings and membership seminars. In sum, the FCC might create something like a frequency coordinator to organize the business of auctioning spectrum.

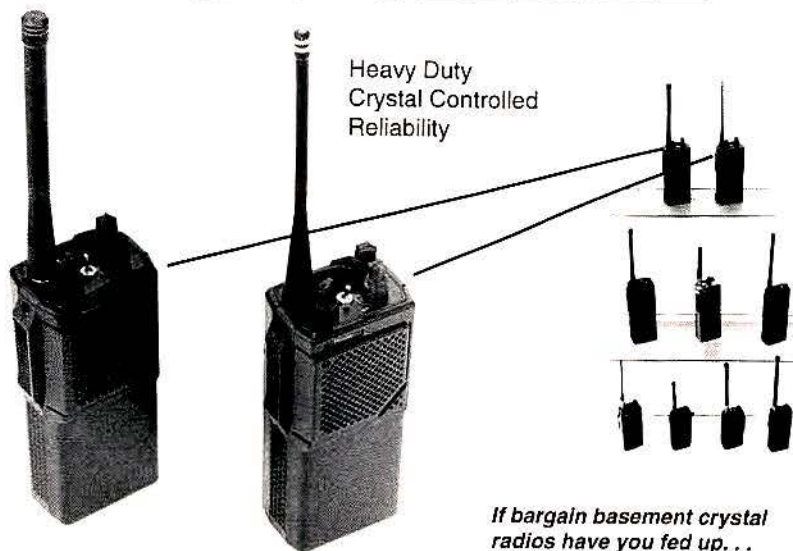
The new auction coordinator will start out with high-sounding ideals and goals, but will eventually succumb to self-interest. It won't be the auction coordinator's fault. It's just the nature of business, even the allegedly not-for-profit business.

When self-interest takes over, the auction coordinator maximizes its resources by ensuring that the entities best able to pay for dues and services wind up with the best deal. This means that, eventually, the small two-way radio dealer will pay for it.

Mind you, most of the foregoing description is merely speculative. It might happen this way (some of it already has), and it might not.

This discussion is only a hypothetical lesson in tracking regulation. We just applied Lesson No. 1: Follow The Money. We also got a good look at Lesson #2: Pass The Buck.

TOP SHELF



then try a Monark heavy duty radio of **QUALITY**.

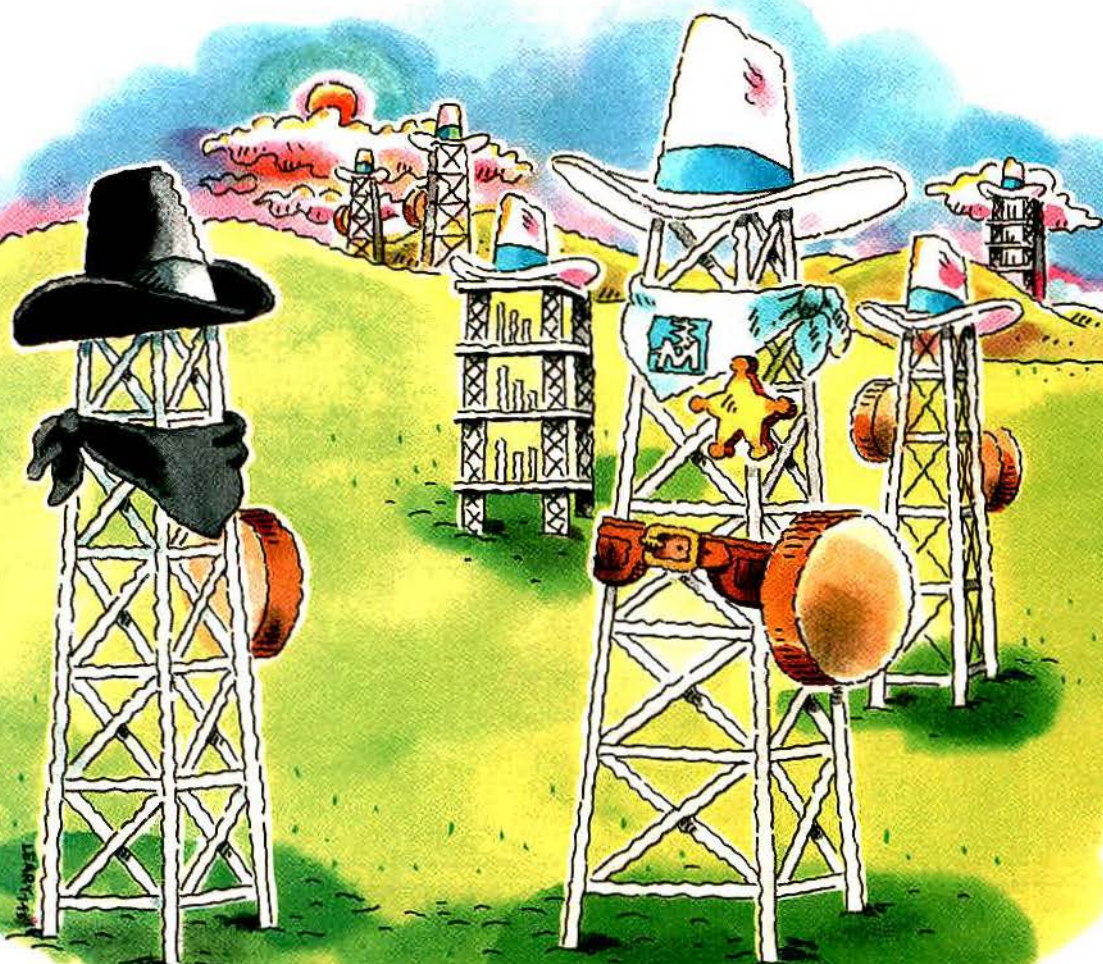
- Five watts of RF, SMD PC board, super strength diecast alloy frame, high impact polycarbonate housing, no squeaks or groans.
- Basic 4 channels, but highly accessorized, good looking yet tough as a junk yard dog, VHF or UHF.

Order today and select your radio from the ... **TOP SHELF !!!**

Monark INTERNATIONAL CORP.
10735 N.W. Ambassador Drive
Kansas City, Missouri 64153
© 1993 Ph. 816-891-0700 Fax. 816-891-0888

Presently selecting dealers.
Call for the name of our REP.
in your area.

Circle (62) on Fast Fact Card



Nobody serves the territory like Meridian.

From the Mexican border to Santa Maria, Meridian has Southern California covered in sites and service.

Our locations are among the most sought after sites in the land. Important features such as stand-by power, air conditioning, security, and all-encompassing maintenance programs are there for the pickens. Many offer conventional and trunked community repeaters, with engineered and combined antenna systems to boot.

This kind of coverage combined with our down home way of doing business has been a family tradition since 1956. And as Meridian continues to grow — adding new sites and capabilities — you can rest easy knowing Rich and Jack Reichler are here to help. Just call our new toll free number, **(800) 400-SITE**.

We're on your side partner!

Great sites, great service, since 1956.



Meridian Communications

23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355
(818) 888-7000 • (800) 400-SITE (7483) • Fax (818) 888-2857

Visit us at Mobile Communications Market Place, September 28 thru October 1, 1993, Booth #102.

Circle (63) on Fast Fact Card

Readers' choice

Of all the new products and services in the February issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Mobile data starter kits work with many radio models

Dataradio starter kits allow mobile radio users, SMR system operators, system integrators and software developers to gain experience with mobile data at a minimum expense and with the flexibility of using a wide range of radios. The kit comes with step-by-step instructions to set up a simple mobile radio network. The VIS24 starter kit works with the E. F. Johnson 8605 and 8600 series, as well as with any conventional two-way

radio system, with or without repeaters. The VIS24 kit includes one 24F3MRM mobile radio modem, one BDLC-1 single port base station datalink controller, DRSETUP configuration software, an MTA modem test adapter for modem and radio alignment, radio interface cables and a documentation package. The VIS system also provides for an "open architecture" system design.

Circle (500) on Fast Fact Card

Phone patch offers DSP voice recognition



The RTU-250 uses an adaptive hybrid to convert the four-wire audio from the transmitter and receiver to two-wire audio for the phone line. It automatically matches any phone line at all voice frequencies simultaneously to provide a broadband null with no oscillation in full duplex systems. Set-up is simple with the phone patch from JPS Communications; neither the VOX nor the adaptive hybrid require any adjustments.

Circle (501) on Fast Fact Card

D&L COMMUNICATIONS TWO-WAY WHOLESALE

(A division of D&L Communications, Inc.)

**TWO-WAY
WHOLESALE
DISTRIBUTION
OF GE PRODUCTS**



- Multi-Million Dollar Inventory
- New and Used, Buy and Sell
- New Dealer Packages

**Five Star
Premier ★★★★★ Dealer**

1-800-336-6825

Circle (64) on Fast Fact Card

BEE™

Quality Leather Cases

We're working our hides for you!

Two-way / Cellular / Paging

We stock more quality top-grain leather cases than anyone else in the industry. Our manufacturing techniques match the advanced specifications of the latest in Portable Radio, Pager or Cellular models.

- Immediate delivery from large inventory.
- Two day delivery on set up orders.
- Logo imprinting. ■ Low pricing.

If you're not getting this kind of service...call today.



Your one-call supplier
for Hard Protection
and Soft Leather Cases.

BEE Electronics, Inc.

2655 Gardner Road, Broadview, IL 60153
Toll Free 800/336-3115 Fax: 800/345-2091

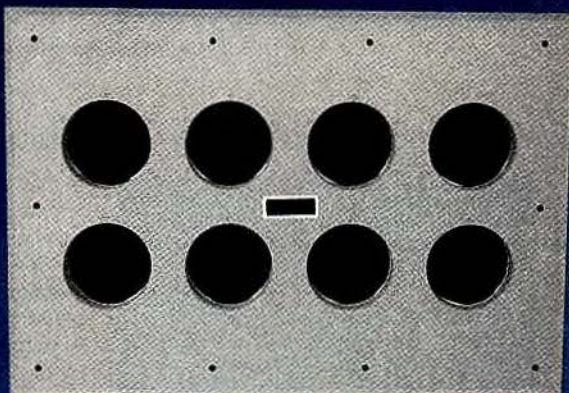
Circle (65) on Fast Fact Card

MORE or LESS



PolyPhaser's Bulkhead System

Compare PolyPhaser's Bulkhead coax cable entry system to the standard entry panel and the logical choice based on features, function and price is the Bulkhead System. 3,5,8,10,16 & 24 ports stocked. UPS shippable.



Standard Entry Panel

Compare our features:

- Multi-port panel of structural 1/8" copper
- Entry boots - one size fits all to 3-1/8"
- Built-in weatherized grounding kits
- Easy fit for 16"o.c. studs (no framing needed)
- 30% lower overall cost than standard entry panels

Compare functions:

- Low inductance grounding for lightning protection
- Low inductance coax protector mounting
- Universal protector mounting plates
- Weather/corrosion proof conductive joint compound
- Copper cleaning kit
- 10 year warranty

There is no comparison - so why pay more for less!

PolyPhaser
CORPORATION ®

1500 models of coax, power and twisted pair protectors ...
plus lightning/EMP and grounding solutions.

(800) 325-7170 ■ (702) 782-2511 ■ FAX: (702) 782-4476
2225 Park Place ■ P.O. Box 9000 ■ Minden, NV 89423-9000

Circle (66) on Fast Fact Card

New products

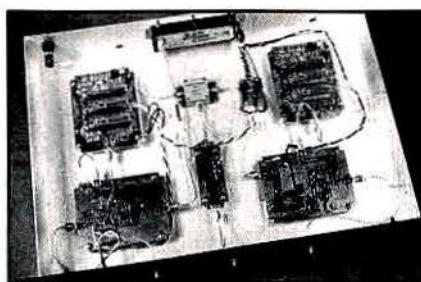
Dual directional coupler operates between 200MHz to 6GHz



Circle (400) on Fast Fact Card

The DDC-HP-201-602-1-30 ultra-broad-band dual directional coupler from **RF Power Components** operates in 200MHz-6GHz frequency bands. Measuring 5.5" x 1.6" x 1.05", the coupler is ideal in power monitoring and power sampling applications and operates with CW power of 500W from 200MHz-1GHz, 250W from 1GHz-4GHz and 100W from 4GHz-6GHz.

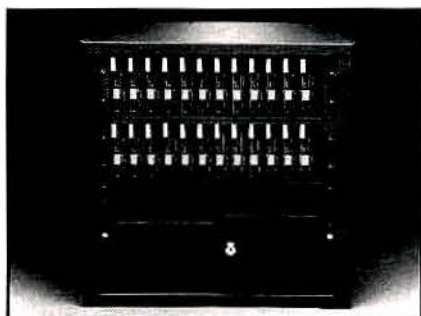
Frequency converter covers bands from 10MHz-1,000MHz



The FTA-400 full-duplex frequency converter connects modulation-compatible, but frequency-incompatible, wireless systems with each other. The FTA-400 is inserted at any appropriate point between the RF transceiver and modem. It can accept two frequency inputs (transmit/receive) and convert to any two other frequency outputs, as long as all are within the unit's overall frequency range. The converter from **Frequency Products** is available in 10MHz-500MHz and 500MHz-1,000MHz frequency ranges.

Circle (402) on Fast Fact Card

Paging terminals interface with analog, digital facilities



Circle (401) on Fast Fact Card

The Prism series of paging terminals feature integrated voice messaging with custom prompts, timed alpha delivery including operator entry of recorded alpha messages, fax delivery of message logs and TNPP networking. The system from **TGA Systems** includes several TNPP network trunk concentrators and TNPP network managers that are compatible with most contemporary paging terminal systems and interfaces with both analog and digital trunk facilities.

"Paging Bomar Crystals!"



Bomar answers the call for excellence with high performance crystals designed for today's pagers. Our crystals are built to precise specs for totally clean, trouble-free reception, and won't drift .001 per cent in one year. We guarantee it. We also guarantee Bomar Crystals will outlive the pager. Check us out.

BOMAR

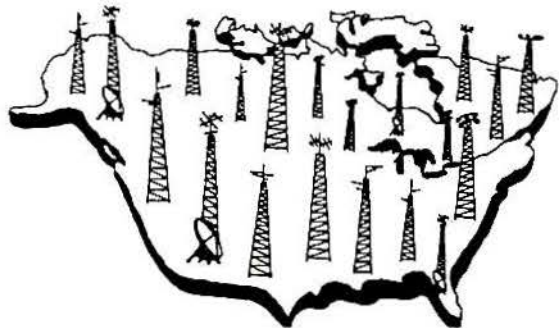
201 Blackford Avenue • Middlesex, NJ 08846

Circle (67) on Fast Fact Card

TITAN™

O W E R S

are sprouting up
all over North America



Available up to 96', TITAN self-support towers offer an unbeatable combination of quality and versatility at a price that makes them an outstanding value.

TRYLON
MANUFACTURING CO. LTD.

P.O. BOX 186, 21 HOWARD AVE. ELMIRA, ONT. CANADA N3B 2Z6
TEL (519) 669-5421 FAX (519) 669-8912

Circle (68) on Fast Fact Card

With the Mini-Com, what you see is less than what you get.



• SL/SM Series actual size — 1.5" x 5.75" x 7"
• SM Series features 16/99 channel scanning with very easy, user friendly operation

PT actual size — 5.75" x 2.25" x 1.25"

Minimum Size, Maximum Punch!

What you see is the Mini-Com® Plus Series from RELM Communications! It's the smallest, most compact radio series we've ever introduced.

But, what you get are powerful, versatile radios that deliver all your communication needs with incredible ease of operation...all at very affordable prices of around \$500.00 or less!*

What more do you get? Just look at some of the features that will help make the Mini-Com® series SL & SM Mobile and PT Portable radios some of your best selling products:

- ▲ Power for strong, far reaching signals.
Mobile: 40 watts VHF/25 Watts UHF
Portable: 5 watts VHF/4 watts UHF *
- ▲ Two-Tone Sequential is built-in to the SL & PT radios. Great for Talk-Back Paging applications.
- ▲ CTCSS and DCS (standard & inverted) are built-in, too!
- ▲ Two control knobs for easy, user friendly operation.
- ▲ 6 channel capability in the SL & PT with detents

for accurate, tactile control. The SL mobiles also feature programmable beeps and bright, easy-to-read LED channel indicators.

- ▲ 16 or 99 channel capability in the SM scanning mobile radio with an easy-to-read display and very simple operation with user selectable features like scan list, priority and talk-around.
- ▲ Rugged die-cast construction and surface mount device technology for outstanding durability and performance.
- ▲ A full complement of options, including DTMF capability.
- ▲ Now with a 2 year parts & labor warranty!

But, what if your customers want more? Fine. RELM offers the RSP Series portable radios and the RM Series mobile radios with enough power, channel capability and features to satisfy the most ravenous high tech, power hungry appetite. And, all RELM radios carry our same firm commitment to quality. So, when you need two-way radios, call RELM Communications, Inc.

We've got the equipment you need!

RELM
COMMUNICATIONS

7707 Records Street
Indianapolis, IN 46226
1-800-821-2900

AN ADAGE COMPANY

Plus

MADE IN USA SL Series & SM Series

* Manufacturers suggested retail price: SMV40-\$512.00, SMU25-\$528.33, SLV40-\$482.00, SLU25-\$498.33, PTV56-\$448.33. PTU46-Not for sale pending FCC approval. Your price may vary.

New products

Paging encoder supports TNPP protocol; encodes POCSAG, Golay



Model 61 network access paging encoder is an automatic encoder that allows

Circle (403) on Fast Fact Card

a paging transmitter to serve as a simple TNPP network node. The paging encoder from Zetron receives TNPP data over the network link and encodes POCSAG and Golay digital pages. It is equipped with 26 kilobytes of buffer space so pages will be efficiently queued when the paging channel is busy.

Dc power systems come assembled, wired, tested

Dc power systems in 12V, 24V, 48V and 130V from Ratelco are shipped assembled, wired and tested in a variety of frameworks. Fuse and circuit breaker panels, ground bars, relay racks and other components are additional options.

Circle (404) on Fast Fact Card

Quartz crystals measure 4.7mm to 8.00mm in height



The UM series of miniature quartz crystals cover the 10MHz-160MHz frequency range. The crystals from Mercury United

Electronics are distinguished by crystal holder height: the UM-1 is 8.0mm, the UM-5 measures 6.0mm and the UM-4 is 4.7mm. Calibration tolerance ± 10 ppm at 25°C and frequency stability ± 10 ppm between -10°C to +60°C is standard.

Circle (405) on Fast Fact Card

Alphanumeric paging software allows 250-character message

Alfie-Jr. is a Microsoft Windows compatible version of Evtex's DOS message center program for alphanumeric paging. Alfie-Jr. allows the user to enter a 250-character message and automatically send it to one or more people in the built-in database. The Tollsaver feature prevents unnecessary redialing, and a date and time stamp can be attached automatically to all messages. The program comes with a 30-day guarantee and an 800-number for product support.

Circle (406) on Fast Fact Card

Module converts radio into trunking radiotelephone

The RTX 7530 mobile control module converts Patriot-150 VHF and RPM-450 UHF mobiles into

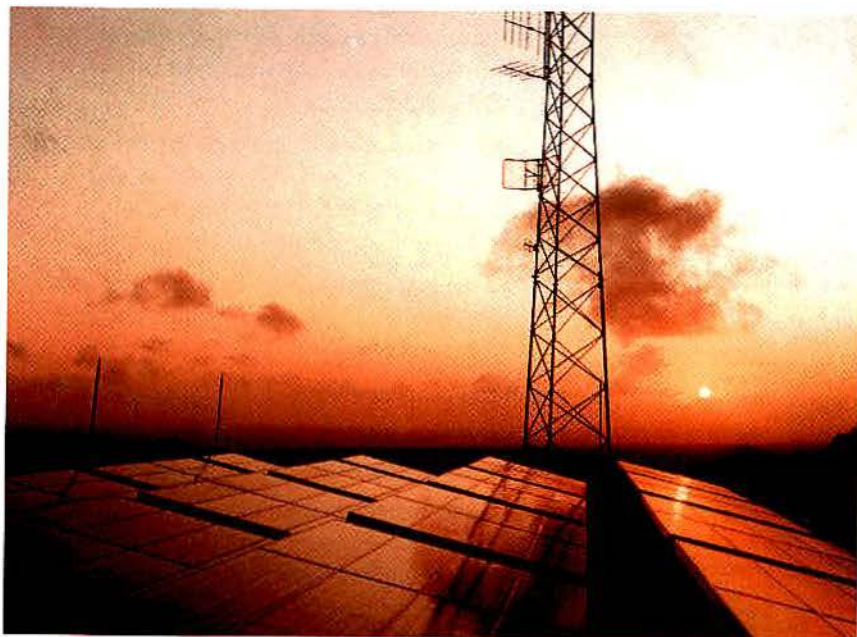


trunking radiotelephone, radio trunking dispatch systems or both. When the RTX 7530-enabled Patriot mobile is connected with the RTX 6000 series repeater controller, the user can make local radio dispatch calls and local, national and international telephone calls.

Circle (407) on Fast Fact Card

SIEMENS

Siemens and the sun.
Dependable power, anywhere.



In telecommunications systems of every sort, from highway emergency-phones used only intermittently, to radio and television stations broadcasting all day—you'll find Siemens solar modules providing continuous, dependable power.

High-efficiency and field-proven performance have made Siemens M-Series modules the leading choice for solar powered telecommunications installations.

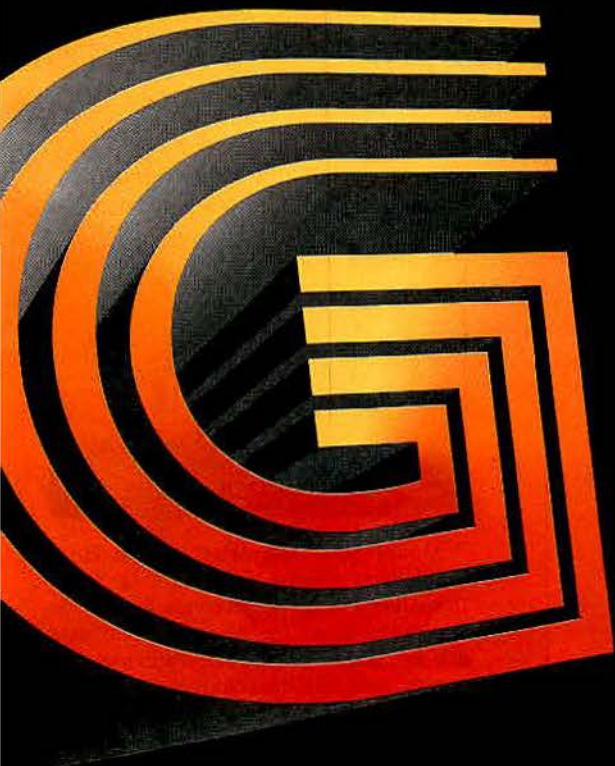
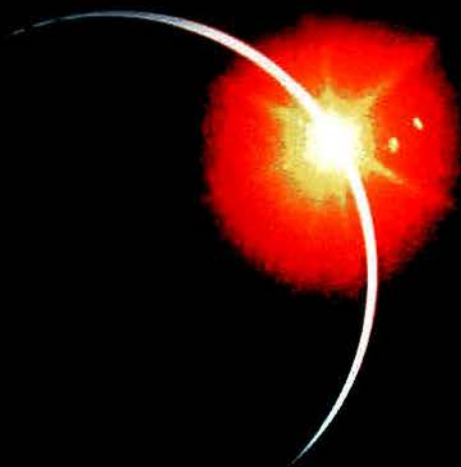
For quality photovoltaic products, backed by a company that can give you the support you need, anywhere in the world, make the intelligent choice. Insist on Siemens.

For complete information contact:

Siemens Solar Industries
P.O. Box 6032
Camarillo, CA 93011
Tel: 1-800/272-6765

Circle (70) on Fast Fact Card

We've listened
to the future,
and it sounds
a lot like...



now.

As distributors of mobile
telecommunications equipment,
like GE's EDACS, ORION
and MONOGRAM lines,
we'll connect your business
with the future...now.

**GENERAL
COMMUNICATIONS**

DISTRIBUTORS OF MOBILE COMMUNICATIONS EQUIPMENT

Because your business takes you everywhere.

5157 Anton Drive • Madison, WI 53719
FAX 608 274-2080 • 608 271-4848
800 356-3200



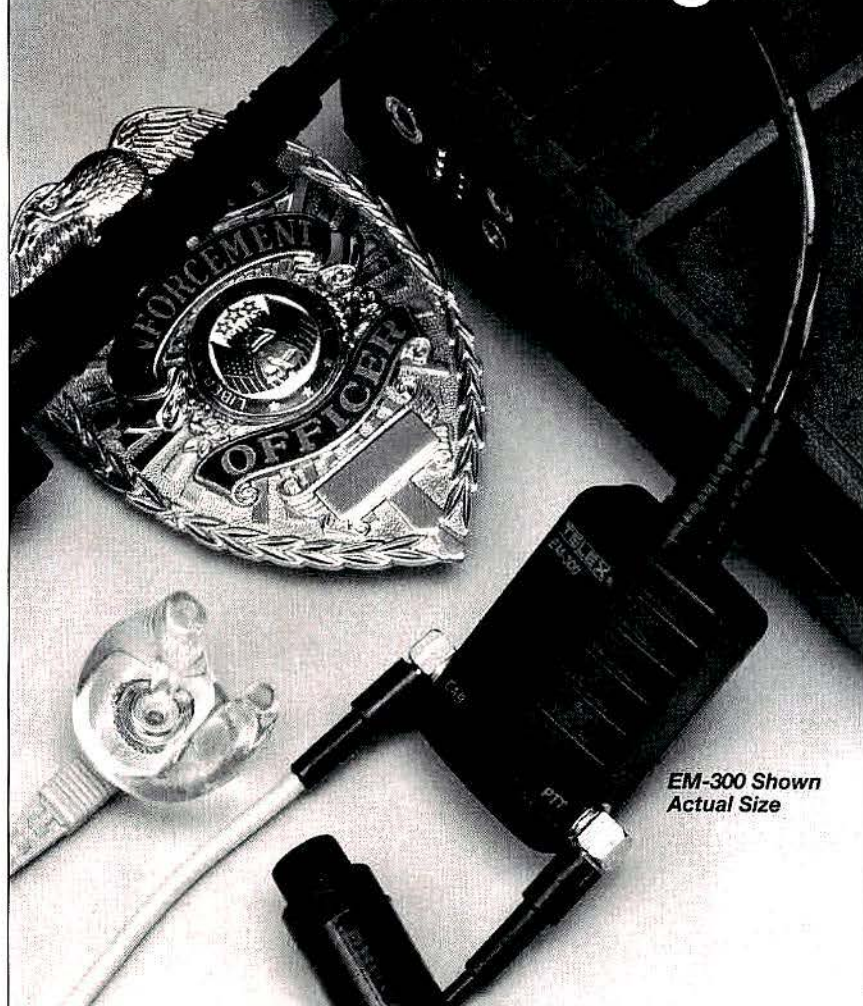
Mobile
Communications

EDACS

See us at Booth 1022 in Philadelphia.

Circle (71) on Fast Fact Card

Ear-Mike® With Hidden Advantages



Telex EM-300 Reliable and Discreet

NEW! Our smallest Ear-Mike yet, the EM-300 delivers the performance you expect in a size that may surprise you. The easy to conceal unit is a discreet 1½" long, 1" wide and ½" thick. But it contains all the power you need for covert communications.

The EM-300 features an exclusive *signal shaping* circuit, which reverses loss in intelligence caused by digitally encrypted signals. And because it derives power from the portable radio, no batteries are required. The EM-300 may be purchased with a palm, ring or velcro push-to-talk switch for virtually hands-free operation.

Unlike our competitors' expensive "disposable" products, the EM-300 features removable PTT and ear cords, so in case of damage, you can replace *them* instead of the entire unit. The back panel also removes for easy servicing or replacement of radio cable.

You can depend on the EM-300 Ear-Mike for discreet communications. To find out more, contact Telex Communications, Inc., at 9600 Aldrich Ave. So., Minneapolis, MN 55420, (612) 887-5530.

©1992 Telex Communications, Inc.

TELEX

Circle (72) on Fast Fact Card

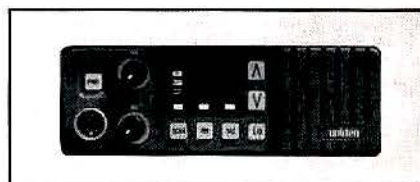
New products

Termination panel has built-in LTR trunking format

IDA model 20-27 tone remote termination panel has the LTR protocol factory-programmed within its microprocessor so that any standard tone remote controller can be used to control E. F. Johnson Challenger radios through the mic jack via the serial port. Other features include PC programmability, 2- or 4-wire audio, 11-function tone decode, 10 outputs, local mic jack and a rugged metal case.

Circle (408) on Fast Fact Card

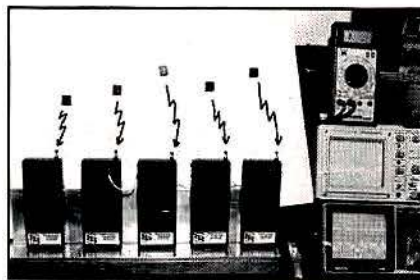
Mobiles offer 99 channels, scanning, CTCSS, DCS



Uniden's IMU3100KT and IMH4100DT are 99-channel synthesized, dash-mounted, two-way mobile radios that feature scanning, multiple CTCSS and DCS. The IMU3100KT covers the 450MHz-470MHz frequency range and offers 30W of power. The IMH4100DT covers frequencies between 150MHz and 174MHz and boasts 40W of power. Both mobiles meet or exceed the Mil. Spec. 810 C, D and E requirements.

Circle (409) on Fast Fact Card

Wireless telemetry system provides analog, digital data transmission



Model 5007 telemetry system from Solid State Electronics uses 1 to 5 FM transmitters and FM receivers to provide data acquisition. The design is solid-state and is a solidly encapsulated wireless system for remotely transmitting 1 to 5 channels of analog and digital data. This is a reliable and convenient wireless method of extracting measurement data from systems that are in severe rotary, linear, vibrating or complex motion.

Circle (410) on Fast Fact Card

BATTERIES • CHARGERS

REPLACEMENTS FOR: TWO-WAY RADIOS • CELLULAR PHONES
CAMCORDERS • LAPTOP COMPUTERS • POCKET PAGERS



MADE IN USA

W & W ASSOCIATES

29-11 Parsons Boulevard, Flushing, N.Y. 11354

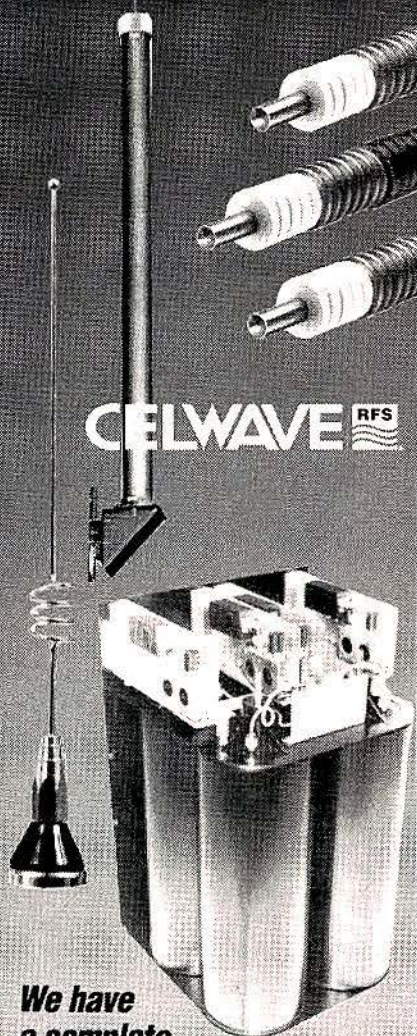
In U.S. & Canada Call Toll Free (800) 221-0732 • In NYS (718) 961-2103 • FAX: (718) 461-1978

WORLD WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE

Prices and specifications subject to change without notice.

Circle (73) on Fast Fact Card

**Santa Fe Distributing
has all your
Cable, Combining,
and Antenna needs!**



CELWAVE RFS

**We have
a complete
line of CELWAVE:**

- Base Station Antennas
- Mobile Antennas
- Duplexer/Combiner
- Cable

SFD

SANTA FE Distributing, Inc.

9640 Legler Rd., Lenexa, KS 66219

913-492-8288

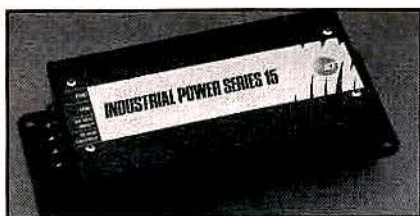
FAX: 913-894-2136

1-800-255-6595

Circle (74) on Fast Fact Card

New products

Converter features vibration-proof design

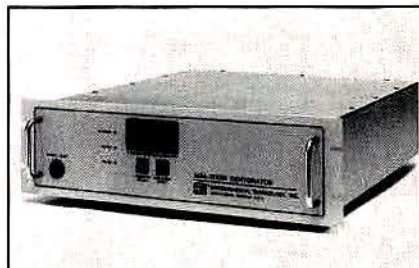


Circle (411) on Fast Fact Card

The industrial series 15 model ICT2412-15AS from ICT is a 15A converter with a vibration-proof design. The circuit board features conformal coating to ensure moisture resistance, and the use of a terminal block guarantees a reliable wiring connection. Other features include a compact case and easily accessible mounting holes.

Air dehydrators work in parallel operations

Environmental Technology's ADH-2COM waveguide air dehydrators can be paralleled for applications: one dehydrator pressurizes while the second is held in standby. The dehydrators communicate with each other through RS-422 serial communications ports, thus providing cooperative operation and equalizing air pump operating times while increasing air flow in the event of excessive leakage.



Circle (412) on Fast Fact Card

Link allows pages to be sent to remote transmitters



Zetron's model 63 DiaLink is a small paging terminal accessory that allows a paging terminal to control a remote paging

transmitter over a low-cost, dial-up telephone connection. A "master" DiaLink is installed at the paging terminal, and a "remote" DiaLink is at each paging transmitter to be remote-controlled. A maximum of 16 telephone numbers can be dialed by the master DiaLink. The unit is programmable by Touch-Tone, allowing the telephone numbers to be changed by the owner from a telephone.

Circle (413) on Fast Fact Card

WACOM

QUALITY*SERVICE*PRICE

...WE DO IT BETTER!

FOR THE 150, 450, & 850 MHz BANDS

- * Low-loss Transmitter Combiners
- * Receiver Multicoupler Systems
- * Coaxial Cavity Filters
- * Duplexers

**Investigate this complete line of
high performance products today!**

PHONE 817-848-4435

FAX 817-848-4209

WACOM
PRODUCTS, INC.

P.O. BOX 21145 • WACO, TEXAS 76702



Circle (75) on Fast Fact Card

SCALA

THE WORLD'S FINEST PROFESSIONAL ANTENNAS FOR 900 MHz MULTIPLE ADDRESS RADIO SYSTEMS

Enjoy top performance and maximum reliability from your 900 MHz Multiple Address Radio System, using Scala/Kathrein fixed-station antennas. The full range of directional and omni types includes collinears, panels, logs, yagis, slots and half-parabolics. Most models include rugged fibreglass radomes to insure reliable operation in icing conditions, a very important consideration at 900 MHz. Designed by Scala and Kathrein, manufactured by Scala in the USA and backed up by Scala's 35-year reputation for the finest customer service, these antennas are "preferred by professionals" around the World for optimum system performance.

We will gladly help with antenna selections and array designs to meet your special needs.

OMNIDIRECTIONAL ANTENNAS

<u>Model</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Pol</u>	<u>Type</u>
UBO-900 (K-7511641)	0 dBd	860-960 MHz	V	Radome-protected Collinear Dipole Array
OGB3-900 (740-251)	3 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
OGB6-928 (740-195)	6 dBd	928-953 MHz	V	Radome-protected Collinear Dipole Array
OGB6-900 (K-7516641)	6 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
OGB9-900 (740-189)	9 dBd	890-960 MHz	V	Radome-protected Collinear Dipole Array
SL-8 Paraslot®	11.5 dBd	928-953 MHz	H	Radome-protected Eight-Bay Slot Array

DIRECTIONAL ANTENNAS

<u>Model</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>F/B</u>	<u>Pol</u>	<u>Type</u>
TY-900	10 dBd	890-960 MHz	20 dB	V/H	YAGI
RY-900	10 dBd	890-960 MHz	20 dB	V/H	Radome-protected YAGI
CL-900	8 dBd	800-960 MHz	35 dB	V/H	Radome-protected LOG
LP10-900 (K-732261)	10 dBd	790-960 MHz	25 dB	V/H	Radome-protected LOG
BP6-900 (A-6335641)	6 dBd	870-960 MHz	25 dB	V	Radome-protected PANEL
BP9-848 (740-217A)	9 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP11-875 (740-028)	11 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP13-875 (A-633061)	13 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
BP16-875 (740-215)	16 dBd	790-960 MHz	20 dB	V	Radome-protected PANEL
MF-900	14 dBd	890-960 MHz	23 dB	V	MINIFLECTOR®
PR-900	18 dBd	890-960 MHz	25 dB	V/H	PARAFLECTOR®

SCALA ELECTRONIC CORPORATION

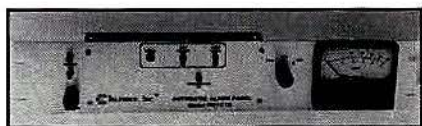
P.O. Box 4580, Medford, OR 97501 (USA)

Phone: (503) 779-6500

Fax: (503) 779-3991

New products

Alarm panels feature built-in wattmeter, 3.5-inch meter display



The PM1C1S one-channel and PM5C1S five-channel alarm panels feature high VSWR and a built-in wattmeter. The 19-

inch panels mount directly inside most base station cabinets and can be powered directly from 120Vac or 12Vdc. The alarm panels from Telewave operate as in-line wattmeters measuring forward and reverse RF power with readings displayed on a 3.5-inch meter.

Circle (414) on Fast Fact Card

Lowband portable covers 30MHz-50MHz frequencies

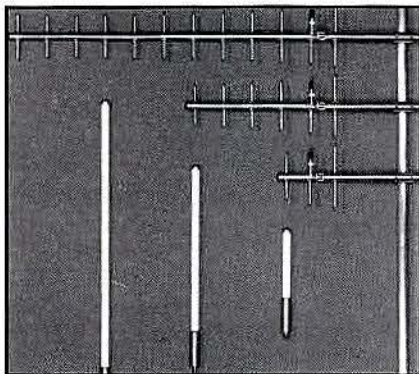
The Patriot lowband RTX-050 portable radio from Ritron offers 11-channel capability, 5W of power, channel scan feature, tone-coded squelch, digital coded squelch and two-tone sequential decode. The radio measures 6.75" x 2.5" x 1.5" and weighs 18 ounces with the battery. It covers the 30MHz-50MHz frequency band.

Circle (416) on Fast Fact Card

Omnidirectional, directional yagi antennas feature gold-anodized mounts

Antenex expands its base antenna product line with omnidirectional and directional yagi antennas. The omnidirectional fiberglass base antennas have a gold-anodized mounting sleeve and a strong filament-wound fiberglass radome. Models are available in unity, 3dB and 5dB versions.

The directional yagi antennas have a computer-optimized design and are made of completely welded gold-anodized 6016-T6 aluminum. Models are available in 6dBd, 7.1dBd, 9dBd, 9.2dBd, 10.2dBd and 11dBd.



Circle (415) on Fast Fact Card

Software manages cellular usage, eliminates scare when bill arrives

The BudgetWatch software module allows the cellular carrier to assign budget limits for their subscribers' usage through an automated system. Once a user reaches 80% of their budget, BudgetWatch will inform the user of their current balance and that they have 20% usage remaining. BudgetWatch from Subscriber Computing also allows an individual with a limited credit history to set up a monthly budget to ensure they do not exceed their ability to pay. The module can accommodate any budget dollar amount for each phone.

Circle (417) on Fast Fact Card

File Police/Fire Comparator Display			
East Police	West Police	Central Police	Inquiry Police
Indian Hill	Miami Heights	Williamson Rd	Comm Center
Williamson Rd	Calhoun Hall	Greenhills	Indian Hill
Glendale W.T.	Cheviot	Engineers	Miami Heights
Comm Center	Comm Center	Glendale W.T.	Calhoun Hall
Loveland W.T.	Mt. Echo	Greenhills	Greenhills
Superior	Miami W	Loveland W.T.	Mt St Joseph
Anderson Twp	Greenhills	Comm Center	Sweetwine
Greenhills	Cleves		Miami W
Engineers	Fernald		Glendale W.T.
Milford	Prov. Hosp.		Harlemont
Marionmont	Mt St Joseph		Milford
Calhoun Hall	Engineers		Cheviot
	Miamitown		Cleves
	Harrison		Williamson Rd
			Prov. Hosp.
			Fernald
			Mt. Echo
			Engineers
			Miamitown

Remote Comparator Display

The Smartswitch II™ Remote Comparator Display monitors and controls voting receiver systems on a personal computer or console. It can be used locally or remotely with leased-line or dial-up modems.

Now you can **get control** of your voting system.

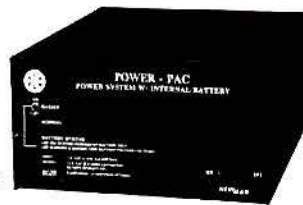


Combined Technologies, Inc.
(513) 595-5900

Circle (77) on Fast Fact Card

How To Tell If Your Base Station Needs A Newmar Power-Pac ... Pull the Plug.

If your communication system dies when you have an interruption in AC power, you need the NEWMAR Power-Pac. It's a 20 amp power supply with a built-in back-up battery which acts as an uninterruptible DC supply when AC power is down.



The Power-Pac's sealed deep cycle 7 amp/hour battery is normally floated at full charge by the supply. If AC power is interrupted, the battery automatically takes over powering the radio. This assures your communication system is up when it is needed most—during a power outage.

Power-Pac, when operating on battery back-up can power a 25 watt radio for up to two hours, based on a 20% tx/rx duty cycle. Indicators on the front panel alert the operator to system status.

Get your base station ready for the next power outage — Use a Power-Pac

NEWMAR
RELIABILITY BEYOND COMPARE

Phone: (800) 854-3906
Fax: (714) 957-1621

Circle (78) on Fast Fact Card

2000 SERIES Paging Terminals

ZETRON

Joe:
I FOUND A BETTER DEAL!

- ZETRON'S MODEL 2200, WITH:
- 3000 SUBSCRIBER MEMORY
 - 2 TELCO TONES THAT SUPPORT VOICE, NUMERIC, AND ALPHA
 - DETAILED TONE OUTPUT
 - 1 CHANNEL VOICE MESSAGING
 - INTEGRATED VOICE MESSAGE DRIVES
 - 6-HOUR MICROLOG DISK DRIVES
- ALL FOR UNDER \$17,000!

THIS ONE IS EXPANDABLE TO 32 TONES, 4 CHANNELS, AND 50,000 SUBSCRIBERS. WE CAN ADD TAP, CALL ROUTING, DIAL-OUT "MEET ME" PAGING.

CALL FOR THEIR CONFIGURATION GUIDE AT 206-820-6363

THANKS, BOB



Hospital Applications



RCCs and PCs



Industry Applications



Utilities Applications

ZETRON, INC.
12335 - 134th Court NE
Redmond, WA 98052-2433
(206) 820-6363 FAX: (206) 820-7031

New products

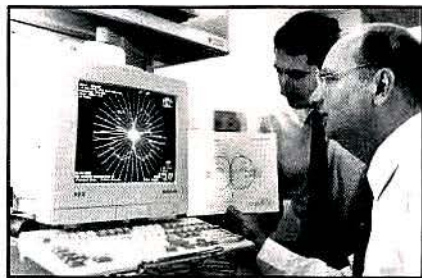
Compact GPS unit stores as many as 99 destinations

The KX-G5500 global positioning system (GPS) receiver from **Panasonic** offers full navigational functions and an internal memory that stores as many as 99 waypoints (destinations) plus nine preprogrammed routes. For use on land or off, the five-channel receiver can display latitude, longitude and altitude. The receiver measures 5 1/2" x 2 5/8" x 1 1/2" and weighs 11.6 ounces.



Circle (418) on Fast Fact Card

Software simplifies base station antenna calculations



RF Tools software program from **Antenna Specialists** helps communication

system designers and operators with base antennas calculate and tailor antennas to their own system requirements. Three disks are included: Dxploit permits precise calculation of beamtilt coverage; Patplot displays and plots digitized base antenna patterns; and Antplot develops patterns for side-mounted base antennas. The programs are available on 5.25-inch IBM-compatible disks, or they can be downloaded through Antenna Specialists' remote bulletin board system.

Circle (419) on Fast Fact Card

Battery charger offers interchangeable cups

The Multi-Charger from **Multiplier** has a base unit with interchangeable cups to condition and rapid-charge two-way radio and cellular phone batteries. Other features include optional deep discharge conditioning; conditioning and charging of nickel metal hydride batteries; and ac/dc adapters for home, office or vehicle charging.

Circle (420) on Fast Fact Card

Scanning portables offer 16-channel capabilities

The SPH516DT 5W VHF and the SPU416KT 4W UHF are 16-channel scanning portable radios from **Uniden**. The VHF model covers 150MHz-174MHz, and the UHF model covers 450MHz-470MHz. Both models are synthesized and feature high/low power switch, a programmable battery saver and multiple CTCSS and DCS. Other options are DTMF keyboard, heavy-duty battery, battery pack for alkaline cells, trickle or rapid chargers, speaker microphone and a narrowband IF kit for 12.5KHz channel spacing.

Circle (421) on Fast Fact Card

SONIC Sound Technology Working for You

The Sonic Throat Microphone allows hands free communication in high noise, severe environments. Police Special Operations and Fire Hazmat Teams can maintain radio contact under adverse conditions.



**CALL OR FAX
FOR MORE
INFORMATION ON
SONIC PRODUCTS**

Sonic Communications Inc.
4 Colonial Center Box 287
New Ipswich, N.H. 03071 USA
Tel: 603-878-1944 Fax: 603-878-1773
Toll Free: 800-688-1944

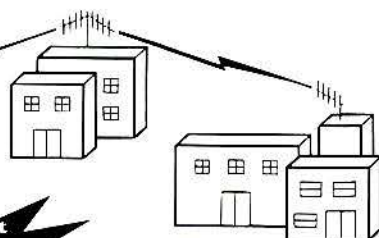


Visit us at IWCE, Booth 1006.

Circle (80) on Fast Fact Card

ARE YOU IN CONTROL OF YOUR COMMUNICATIONS—

Keep Your System
SMALL
EFFICIENT
INEXPENSIVE



Systems Start
As Low As
\$2395

These devices allow regular telephone service to be extended from or to remote sites.

When Communication Is Critical—

A Wireless Telephone
System Is A Must

Available Immediately

Send for **FREE** copy of DataCom's
full line of Radio Products.



DataCom Systems, Inc.

520 No. 30th • P.O. Box 3485 • Quincy, IL 62305 U.S.A. • Tel.: (217) 222-0160 • Fax: (217) 222-0912

Circle (81) on Fast Fact Card

ATTENTION

PUBLIC SAFETY ANNOUNCEMENT

Tampering with Motorola's Communication Technology is Nothing Short of a Crime.

Motorola has been at the forefront of communications technology for more than 60 years. Today, we offer a greater array of communications products than ever before. We are proud of our products and the vital services they bring to our customers which are of unparalleled public importance.

Theft of communications services and so-called High-Tech piracy threaten the entire communication industry's reputation for reliability. This conduct

not only damages the reputation of Motorola, Inc. and the communications industry, but undermines the very integrity of America's public and private communications services.

Motorola intends to combat this conduct by aggressively maintaining and enforcing its proprietary rights to its hardware and software technology. Anyone who has knowledge of illegal activities or has questions concerning such activities is urged to contact Motorola Inc. immediately at 1-800-325-4036. Contacts will be kept confidential and may be made anonymously.



® and Motorola are trademarks of Motorola, Inc., © 1993 Motorola, Inc.



New products

Telescoping tower offers portable tower solution

The GME telescoping tower is 15'6" in its closed position on the trailer and weighs 157 pounds. The trailer that the tower is mounted on is equipped with outriggers to stabilize the tower in high winds. By using a hand-cranked winch system, the 50-foot tower can easily be erected with minimum time and manpower. The tower uses stainless steel bolted assembly rather than welding for strength and durability.

Circle (422) on Fast Fact Card

Base station antennas withstand 150mph wind without ice



Power Master heavy-duty, high-gain, omnidirectional fiberglass antennas feature a "cool blue" design that blends with the skyline and absorbs the rays from the sun to assist in de-icing the antenna. The antennas' strong interwoven fiberglass housing withstands wind loading of as much as 125mph with 1/2-inch of radial ice or 150mph wind loading without ice. Telewave models include ANT150F6, 138MHz-174MHz, 6MHz bandwidth and 6dB gain; ANT220F6, 216MHz-225MHz, 9MHz bandwidth and 6dB gain;

ANT450F6, 450MHz-470MHz, 20MHz bandwidth, 6.2dB gain; ANT450F10, 450MHz-470MHz, 20MHz bandwidth and 10dB gain; and ANT860F10, 806MHz-866MHz, 60MHz bandwidth and 10dB gain.

Circle (423) on Fast Fact Card

Crimp plugs fit land mobile, cellular equipment

The RFU-600-6 mini-UHF crimp plug for RG58/U cable is machined from solid brass, nickel plated and has a gold-plated brass crimp pin. The cable crimps both the pin and the shield crimping to the ferrule stud of the connector.

The RFU-600 field installable mini-UHF plug for RG58/U cable can operate past 1.5GHz and handles power in excess of 150W, with VSWR of less than 1.2 to 1. The "no-tool" plug is ideal where a fitting is considerably smaller than a BNC. The connectors from RF Industries are useful on Motorola's land mobile and cellular radio equipment.

Circle (424) on Fast Fact Card

Repeater may be used as part of system, independently

The RTL-1000R from Telepoint is a full-duplex back-to-back or crossband repeater that may be used to extend range or to overcome path obstructions to provide proper signals to the subscriber's location. The unit may be used independently or as part of the Unitel RTL-1000 microprocessor-controlled radiotelephone link.

Circle (425) on Fast Fact Card



Headset uses split audio, reduces multiple radio traffic confusion



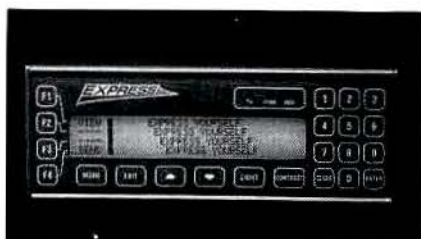
The Setcom split audio headset provides OSHA-approved hearing protection and the capability to broadcast and receive on two radios, AM or FM. The headset uses split audio to reduce multiple radio traffic confusion. The tower radio is heard in the right ear; dispatch in the left. The operator talks through a noise-canceling lip microphone.

Circle (426) on Fast Fact Card

MDT software suits user's individual needs

The Express mobile data terminal from Mentor Engineering has its own form-based operating system (FBOS). The FBOS provides software background for programmable forms, function keys and software menus so that the Express MDT software can be tailored easily to suit each customer's application requirements. The Express MDT features an optional alphanumeric keyboard and multiple serial ports for connecting to peripheral devices, such as GPS receivers, printers, card readers and third-party data networks.

Circle (427) on Fast Fact Card



Solar/Cell Batteries



For all your remote power needs:

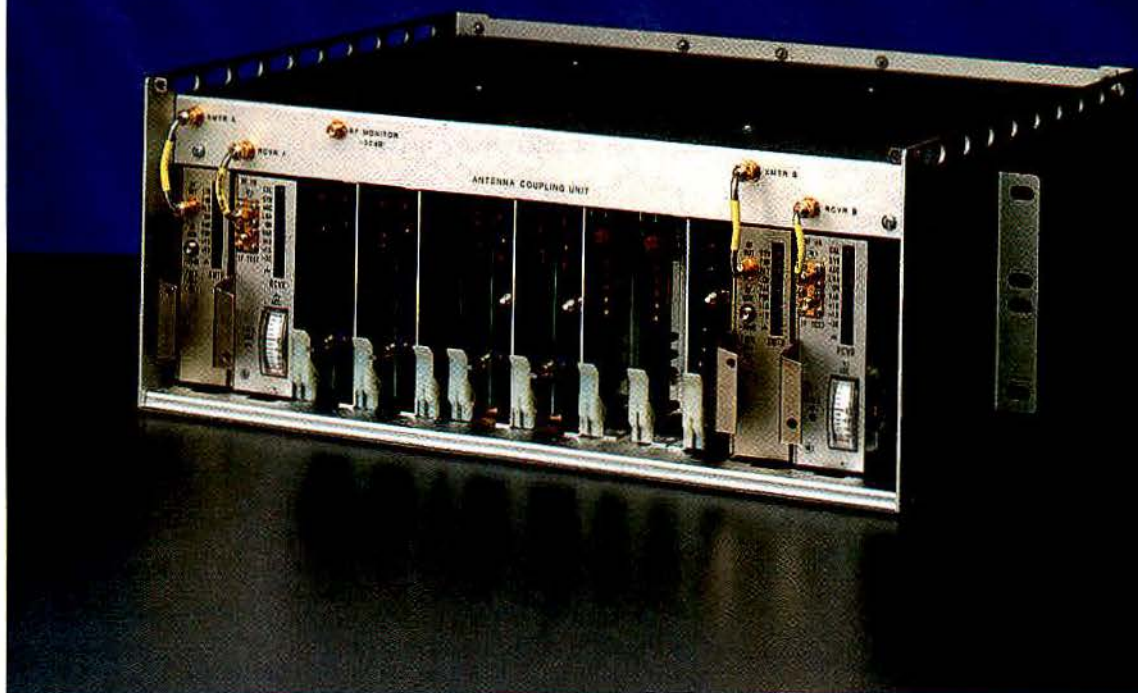


**SOLAR ELECTRIC
SPECIALTIES CO.**
P.O. Box 537 Willits, CA 95490

Order Hotline 800-344-2003

Circle (83) on Fast Fact Card

Your First Choice In Analog Microwave Radio...



... because the first new analog microwave radios in more than a decade, for light spur routes and medium density backbones, are available...

... from the innovators who designed the LYNX—the first T1 spread spectrum digital microwave radio...

... with complete systems integrated on single cards so that spare units perform identically to operating units...

... and stripline RF circuits and surface mount components ensure stable performance and exceptional reliability.

- ONE-2000 12-132 CH 1.7-2.5 GHz
- TWO-2000 120-600 CH 1.7-2.3 GHz
- TWO-6000 120-600 CH 6.525-6.875 GHz

Phone or FAX us for more information.

**"Still Supporting Analog
Transmission Systems"**



310 Harbor Boulevard, Belmont, California 94002
(415) 592-8832 • FAX (415) 592-4249

New products

Digital audio recorder records for two hours

The **Addcom** digital audio recorder allows as much as two hours of high quality audio recording without tapes. Each call is individually date and time stamped and has a caller ANI option, DTMF or FSK decode. Individual calls may be reviewed

without disturbing recording functions because of a simultaneous record and playback feature. All recordings saved as a cassette tape archive include date, time and ANI information.

Circle (428) on Fast Fact Card

Paging encoder offers 12 two-tone calls

The PE-12 is a 12-call paging encoder using the two-tone sequential paging format. Packaged in a high impact plastic case with a mounting bracket, the unit from **Communications Specialists** is configured for mobile base stations that need to signal a handful of pagers with discrete calls.



Circle (429) on Fast Fact Card

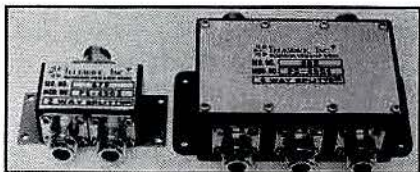
Software package aids in design, management of microwave network

The Multiplex channel Accessing, Planning, Networking and Equipment Tasking (Mapnet) software package helps in the design and management of microwave networks. The software from **Nucomm Data** makes multiplex channel assign-

ments for new service or service reassignment and automatically seeks an available circuit path from an internal database. The software operates in Microsoft Windows 3.x and uses a visual graphics map interface with a selection of map data.

Circle (430) on Fast Fact Card

Power splitters provide system design flexibility



Two-way and four-way power splitters from **Telewave** provide flexibility in system design and minimize cost for interconnect cables by providing two or four

outputs from one input. Models include: PS-302 lowband two-way splitter for 33MHz-50MHz; PS-1502 VHF two-way power splitter for 132MHz-174MHz; PS-4502 UHF two-way power splitter for 400MHz-512MHz; PS-8902 800/960 two-way splitter for 806MHz-960MHz; PS-1504 VHF four-way power splitter for 132MHz-174MHz; and PS-4505 UHF four-way power splitter for 400MHz-512MHz.

Circle (431) on Fast Fact Card

Repeater/base station supports simulcasting, voice and data

Microprocessor-controlled and engineered for high-density sites, the Eclipse line of frequency-synthesized VHF and UHF repeater/base stations made by **RF Technology** are compatible with simulcast operations. The modular units fit 19-inch racks and come with SWR and thermal protection. With 100W-rated power am-

plifiers (50W continuous), the units have a 100-channel capacity, programmable CTCSS and built-in alarm functions. Diagnostics are available, and the units are DCS repeat capable. They boast 20mS transmit-receive switching for efficient data transmission. The units are FCC and DOC approved.

Circle (432) on Fast Fact Card

Connectors fit 1/2", 7/8" corrugated cables

RF Industries'

corruflex cable connectors fit popular 1/2" and 7/8" foam dielectric corrugated cables. Installation takes 3-5 minutes, and no special tools are required, although a simple copper tube cutter is helpful. After installation, the connector offers more than 250 pounds of pull strength against the cable.



Circle (433) on Fast Fact Card

Repeater panel active for 160 user groups



The 38-Max repeater panel from **Zetron** has 50 subaudible tones and 110 digital codes. All of the tones and codes may be active simultaneously for a maximum of 160 user groups. The 38-Max may be programmed by DTMF over the radio channel or by a PC connected directly or via modem to the RS-232 port built into the front panel. The unit has an internal airtime accumulator that compiles a record of how much airtime is used by every subaudible tone and digital code.

Circle (434) on Fast Fact Card

Pager offers colorful covers



The Lifestyle Plus pager from **Motorola** has a 12-digit numeric display, 16 message slots, message time stamping and silent vibration. The pager features time-of-day display, message lock for as many as four messages and a backlit display. Contemporary color covers include smoke, ice, ultraviolet, totally teal and arctic white.

Circle (435) on Fast Fact Card



Synthesized, Field Programmable
11 channels
5 Watts VHF/UHF
8 Hr Battery Life,
10 Hr Battery Available
Frequency Bands: 136-174
400-430, 450-512 MHz
Wide Band Operation:
VHF 15MHz/UHF 20 MHz
Scan
Tone Coded Squelch
Digital Coded Squelch
Two-Tone Sequential Decode
Rugged, Uni-Body Housing
Two Year Factory Warranty
Made In USA

VHF \$429 UHF \$449



Synthesized, Field Programmable
16 channels
30 Watts VHF 25 Watts UHF
Frequency Bands: 136-174
400-430, 450-512 MHz
Wide Band Operation:
VHF 15MHz/UHF 20 MHz
Scan
Tone Coded Squelch
Digital Coded Squelch
Two-Tone Sequential Decode
Rugged, Uni-Body Housing
Two Year Factory Warranty
Made In USA

VHF \$469 UHF \$499

*Portable comes with battery, antenna, wall charger and belt clip.
Optional accessories: DTMF keypad, speaker microphone, earphone
or headset, fast rate drop-in charger and carry holster.*

*Mobile comes with installation kit, band microphone
and external speaker jack. Optional accessories: DTMF
band microphone and 5 watt external speaker.*

DEAL WITH IT.

The new line of Patriot two-way radios really gives you something to deal with. Not only do you receive the benefits of a premium product line that's built in the USA by Ritron, but a product line with high dealer margins. And even more than that, you get strong dealer

support from the factory. It's true we have Patriot radio dealers worldwide, but right now a limited number of dealerships are still available. So take advantage of a truly patriotic deal, and call us at 1-800-USA-1-USA. **PATRIOT**
FAX: 317-846-4978. BY RITRON

Circle (85) on Fast Fact Card

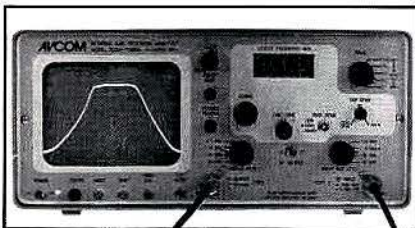


Two Year Warranty applies to product sold in USA. Certain frequency bands special order.

New products

Analyzer covers 1MHz-1,000MHz frequencies

Avcom's NASA-1000A can be used as a stand-alone 1MHz-1,000MHz spectrum analyzer with an internal FM demodulator or used as a network analyzer by activating the built-in tracking generator. The unit is ideal for receiver and transmitter alignment and troubleshooting, and RF communication system testing. It measures 11.5" x 5.5" x 15.5" and weighs 18 pounds.



Circle (436) on Fast Fact Card

System detects presence of lightning; disconnects, grounds equipment

The ILD-P lightning protection system detects the presence of lightning when a storm is typically 2-5 miles away and protects equipment by automatically disconnecting and grounding power sources, telephone lines and coax cables. Features include a bargraph which shows line disturbances and/or lightning in the area and a special disable mode which will not allow the equipment to power down while in use. The system from Rabun Labs is designed for land mobile base station equipment;



nonetheless, other models are available to protect computers and data processing equipment, satellite receiving systems, pump motors and CCTV systems.

Circle (437) on Fast Fact Card

Cables offer lower attenuation, flexibility

The SFT series of cables from Times Microwave Systems uses high-performance taped PTFE dielectric for lower attenuation and greater flexibility. The SFT cables are fully tested for guaranteed attenuation and VSWR performance.

Circle (438) on Fast Fact Card

Trunking portable offers five scan modes

The TP-4800 800MHz portable radio features trunked and conventional operation with 10 systems and 10 groups; 100 conventional channels; programmable talk around; and five scan modes: system, auto group, user-activated group, Rx priority and first available system. The DTMF keypad allows for storage and recall of eight telephone numbers. The alphanumeric display has a 7-character LCD and icons, and it is backlit for easy viewing. The radio from Maxon measures 7" x 2.5" x 1.5" and weighs 1 lb., 7 oz.



Circle (439) on Fast Fact Card

Soldering control station provides precise temperature settings



The Antex TCSU-1 temperature control station features a sliding potentiometer that provides precise temperature control settings and a 30W precision miniature soldering iron that is safe for use with heat and sensitive components. The soldering control station from M.M. Newman is powered by 115Vac and converts the line voltage to 24V. Tip temperatures adjust from 160° to 815°F, and the soldering iron's heating element is under the tip for optimum thermal efficiency.

Circle (440) on Fast Fact Card

uniden®
MICRO

VCP
For Your Communications Needs

N U M E R I C

- VHF, UHF, 900 MHz
- POCsag signalling format
- Selective message delete

- Holds up to 16 messages
- 128 character memory
- Uses one "AA" alkaline battery

P.O. Box 550999 • Dallas, Texas 75355-0999 • Toll-Free 1-800-527-9366 • Fax (214) 278-5981

Circle (86) on Fast Fact Card

RADIO ENGINEERING PRODUCTS

♦ **SOFTWARE**

- 3-D Terrain
- Coverage Predictions
- Fresnel Zone Studies
- Engineering Package
- Intermodulation Studies
- 3 or 30 Second Terrain Files

♦ **FCC INFORMATION**

- Dial Access
- State Frequency Lists
- Custom Searches
- Mailing Labels
- Print-outs
- Data Files

C.E.T., INC.
1001 S. Ridgewood Ave.
Edgewater, FL 32132
Phone: 904-426-0014 • Fax: 904-426-0099

Circle (87) on Fast Fact Card

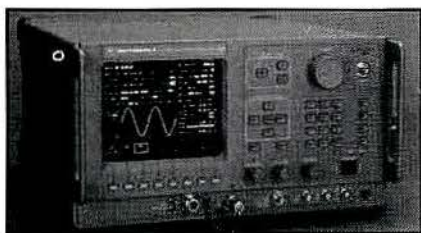
Batteries feature low self-discharge in 7.2V, 8.4V, 9.6V



Plainview Batteries' 7.2V, 8.4V and 9.6V NiCd batteries feature low self-discharge, high energy storage, stable discharge voltage and low internal impedance. The batteries come in three standard packages as well as replacement applications. The 9.6V model can be recharged more than 500 times.

Circle (441) on Fast Fact Card

System analyzer services conventional two-way radios

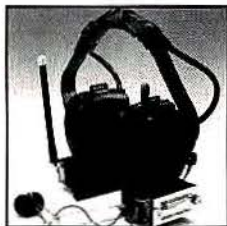


Motorola's R-2550 provides a fully variable output level duplex generator and automatically calibrated spectrum analyzer for servicing conventional two-way radios. Features include a 7-inch diagonal CRT, lightweight and portable styling, and digital storage scope.

Circle (442) on Fast Fact Card

Headset features rotary volume control

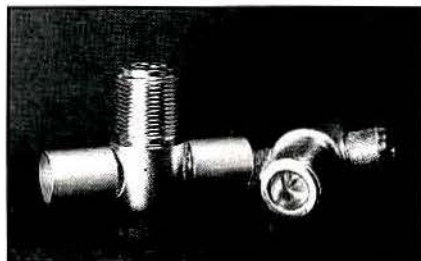
Variable volume control is a new feature with Earmark's Series IV headsets. It allows the user to adjust the incoming volume with a turn of a knob without worrying about environmental noises flooding the network. Located behind the receiver earcup, the rotary switch is easy to find and large enough to control with a gloved hand. The self-adjusting Series IV headset is listed as intrinsically safe by UL and is backed with a three-year parts and labor warranty.



Circle (443) on Fast Fact Card

Type N tee connector offers design versatility

Delta Electronics' tee connectors are useful for tapping a signal transmitted through a coaxial cable in mid-line, or feeding two duplexed signals into a single receptacle. The connectors are available in crimp attachment for flexible cables or solder-type for semi-rigid cable. The connectors meet MIL-C-39012 specifications and are equivalent to MIL-C-39012 type N right-angle connectors for coaxial cable.



Circle (444) on Fast Fact Card

Page buffer offers 120 seconds of storage time

Model 55B from Zetron is a storage device designed to enhance the operation of a remote paging transmitter that experiences co-channel activity. Installed between the transmitter and the link to the central paging terminal, the page buffer stores analog and digital pages that are received from the link and then forwards them to the transmitter when the channel is clear. Features include 120 seconds of storage time, enough to store as many as



eight 12-second voice pages or more than 100 digital pages; an elastic buffer that receives and sends simultaneously, preventing lost pages; and a software-based VOX detector.

Circle (445) on Fast Fact Card



Panasonic



VCP

For Your Communications Needs

N U M E R I C

VHF, UHF, 900 MHz

Buy one or 1,000 — with no minimum order, VCP lets you buy only the stock you need. And our same day shipping* gets it to your shelves fast!

*On in-stock items ordered by 12 noon CST

P.O. Box 550999 • Dallas, Texas 75355-0999 • Toll-Free 1-800-527-9366 • Fax (214) 278-5981

Circle (88) on Fast Fact Card

INTERFERENCE LOCATION



- ★ 50 to 1000 MHz
- ★ Stuck Microphones
- ★ Cable TV Leaks
- ★ Jammed Repeaters & Cell Sites



New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 50 MHz to 1 GHz. Call or write for details.

DOPPLER SYSTEMS, INC.

P.O. BOX 2780 (602) 488-9755
CAREFREE, AZ 85377 FAX (602) 488-1295

Circle (89) on Fast Fact Card

Catalog features tone signaling products

The 25th anniversary free catalog from **Communications Specialists** contains listings and brief descriptions of CTCSS and digital CTCSS encoders and decoders, repeater products, paging encoders and decoders, and other miscellaneous tone

Circle (300) on Fast Fact Card

Electronic bulletin board covers RF propagation software

TeleTAP is an electronic bulletin board that can be accessed at no charge by both existing and prospective **SoftWright** customers. E-mail can be left for both sales and product support departments. Many types of demonstration software are available for downloading at no charge, and

Circle (302) on Fast Fact Card

Catalog describes vehicular land mobile antennas

A vehicular land mobile catalog gives details on all of **Mobile Mark's** antennas and accessories. It lists the lowband, VHF, UHF and trunking antennas for mobile applications. The lowband Heliwhips are included, as well as new products such as the flexible whip RF series antennas for trunking applications. Model numbers and descriptions are listed with each product, as well as electrical and mechanical specifications.

Circle (304) on Fast Fact Card

Data sheet illustrates trunking radiotelephones

A data sheet from **RTX** describes the features and advantages of the RTX 8700 series Bagfones, which are available in full-duplex and half-duplex models. The

devices. The catalog features the new ID-8 Morse station identifier and PE-15 paging encoder for local addressing of POCSAG display pagers. Included in the catalog is an application note on putting together a low-cost mobile paging encoder.

callers can receive answers to frequently asked questions or ask their own to learn some basics about RF propagation software. Authorized Terrain Analysis Package (TAP) users are given access to software updates and E-mail to all other TAP users through TeleTAP.

Book includes FCC regulations

The NABER Resource: FCC Rules, Regs & Licensing includes FCC regulations for Part 17. This section addresses tower maintenance, lighting and other tower issues. The book provides an updated Part 90, containing rule changes through Jan. 1, 1993. Also contained in the book are a how-to guide for completing FCC forms; a subject index; an annual review explaining all rule changes that occurred in 1992; and an updated listing of all FCC field offices and FCC-certified frequency coordinators.

Circle (305) on Fast Fact Card

Brochure covers base station antennas

An eight-page brochure shows base station antennas for both nationwide and non-nationwide 220MHz-222MHz services, coaxial cables and accessories, and mobile antennas for On-Glass, hole and magnetic mounting. Individual product data sheets are also available from **Decibel**.

Circle (301) on Fast Fact Card

Coaxial connector catalog includes 150 new items

A 36-page catalog from **RF Industries** presents an expanded range of coaxial connectors, including 150 new items. Extensive coverage of BNC, TNC, N, UHF, Mini-UHF, MB, SMB, SMA, SMC and $\frac{1}{8}$ " and $\frac{1}{4}$ " corrugated cable connectors. The catalog includes more than 750 coax products, including cable assemblies, connector kits, unidapt and celludapt universal adapter products.

Circle (303) on Fast Fact Card

Catalog features miniature rechargeable batteries

A catalog from **Plainview Batteries** features standard and custom miniature rechargeable batteries—nickel-cadmium and nickel-metal hydride—in a variety of form factors: axial and radial leads; flat-paks; in Eco-Pak battery holders; with double- and single-mounting pins; and 7.2V, 8.4V and 9.6V assemblies. Included are complete lines of button cells in both chemistries for custom assemblies, and performance curves and recommended charge rates for all products described.

Circle (307) on Fast Fact Card

Catalog includes mobile radio, paging, SMR equipment

A 400-page catalog shows land mobile radio, SMR, paging, cellular and solar electric equipment. The catalog from **Hutton Communications** features more than 6,000 of their most popular items from more than 80 manufacturers. Products are organized into 20 categories, and the catalog contains more than 400 photos and charts.

Circle (308) on Fast Fact Card

Brochure describes amplifiers

A brochure from **AML** includes full specifications for 17 power efficient feed-forward, linear power amplifiers. Peak envelope powers range from 7W to 120W with gains to 70dB. Both rack-mount and compact units are described.

Circle (309) on Fast Fact Card



Express yourself

Something bothering you? Want to sound off about it?

Need help that other readers might provide?

Send a letter to:

Letters to the editor
Mobile Radio Technology
P.O. Box 12901
Overland Park, KS 66282-2901



Reasons for joining a trade association

General interest is the reason 54.8% of the respondents of February's "What Do You Think?" questionnaire joined a trade association. Other reasons include: (multiple answers add up to more than 100%)

Networking	47.6%
'Political voice' in Washington, DC	38.1%
Seminars	28.6%
Training	26.2%
Other	28.6%

Readers are affiliated with the following association:

NABER	35.7%
APCO	33.3%
NARTE	16.7%
Radio Club of America	9.5%
AMTA	7.1%
ITA	4.8%
RadioComm	4.8%
UTC	4.8%
FCCA	2.4%
Telocator	2.4%
Other	14.3%

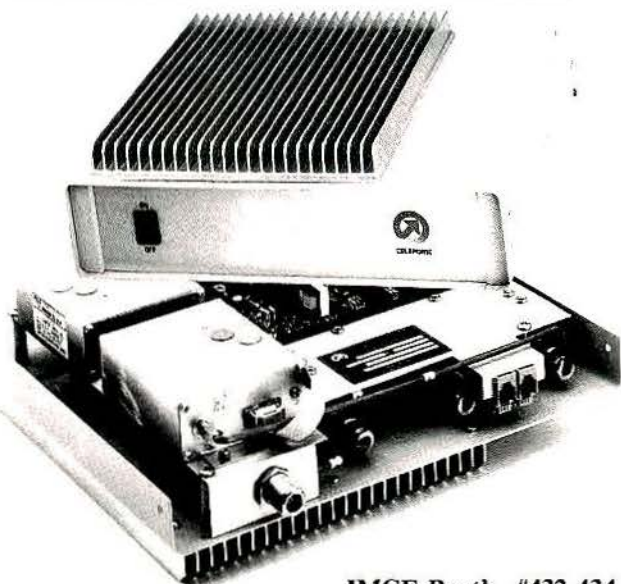
Readers commented about the advantages of being a member of an association:

- "Allows closer watch on trends and rulemaking in the industry."
 - "Educational opportunities are the most up-to-date and expansive, and the free sharing (of information) between members is better than any school."
 - "Keep abreast of job openings, certification standards and technical articles."
 - "Larger organizations are available to assist smaller groups within the association."
 - "Political action and activities."
 - "Common problems are discussed, and avenues are taken to alleviate them."
 - "Good current information. Different points of view on similar issues."
 - "Seeing new updates on equipment, servicing techniques and servicing aids."
 - "Staying abreast of industry and regulatory trends; political representation."
- Disadvantages readers noted were:
- "Cost of membership."
 - "Too many in-person meetings all around the country. Can't attend due to budget and time constraints."
 - "Associations are too focused by user group, i.e., business, police, etc. Would like focus on two-way dealerships who deal with broad spectrum of user types."
 - "High dues for what services are received."
 - "If active, the time expected of you to devote to the group."
 - "None, if you stay out of the political in-fighting, maintaining objective on an issue."
 - "To be fully active, it requires a good deal of time, but the rewards are well worth it."



AT LAST... DIGITALLY-CONTROLLED RADIO TELEPHONE SYSTEMS

**TRANSMIT VOICE, FAX AND DATA FOR AN
INCREDIBLY LOW COST WITH TELEPOINT'S FULL
DUPLEX PRIVATE RADIO TELEPHONE LINKS.**

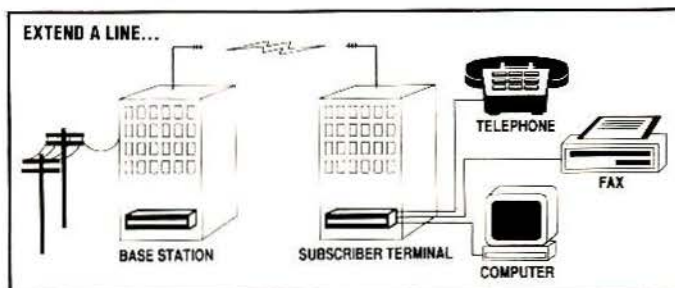


IMCE Booth, #432-434

The Unitel RTL-1000 is the most advanced radio telephone link ever developed...giving you all these benefits, and more:

- Digital control for absolute reliability
- Full duplex selective intercom
- Exceptional audio quality-produced by a compander
- 900/800 Mhz/UHF & VHF bands
- 2 to 100 watts RF output
- Currently in operation worldwide

At Telepoint, we deliver quality, performance and reliability...with the radio telephone systems of the future!



CALL NOW

**FOR MORE INFORMATION ON TELEPOINT'S ENTIRE LINE OF TELEPHONE LINE
EXTENDERS...AND YOUR FREE SYSTEMS PLANNING GUIDE.**

TELEPOINT INC.

1022 South La Cienega Blvd., Los Angeles, CA 90035

Toll Free: **(800) 333-6444**

Phone: **(310) 652-3666** Fax: **(310) 652-0777**

Circle (91) on Fast Fact Card

Put up a Larsen. Or who knows what you'll have to put up with.

When you sell a trunking system, maximize its performance with a superior, perfectly matched antenna. A Larsen antenna. Otherwise, you might have to put up with an unhappy customer.

Good antennas are imperative to good SMR communications – especially as radio systems continue to improve. So the right antenna, mount and cable are more critical than ever before.

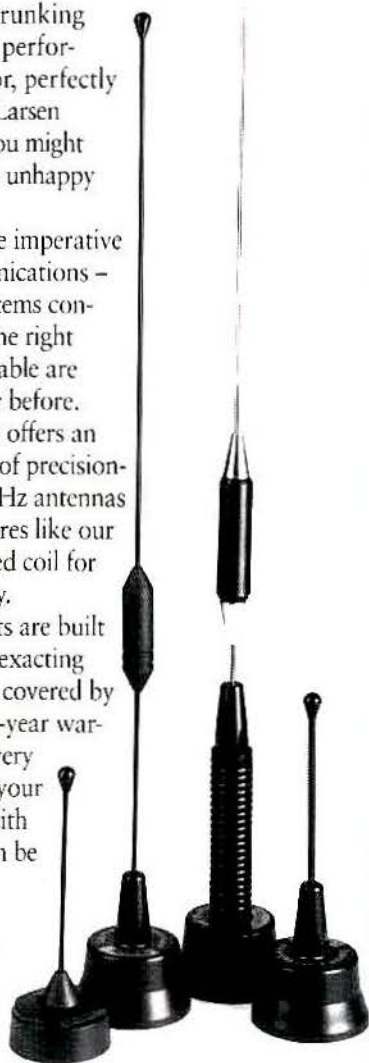
That's why Larsen offers an unsurpassed selection of precision-made 800 and 900 MHz antennas with special new features like our unique flexible enclosed coil for greater whip durability.

All Larsen products are built to the industry's most exacting standards. And all are covered by our no-nonsense three-year warranty. All of which is very reassuring. Because if your customers can't talk with their fleets, they'll soon be talking with you.

So talk with us.
Call 800-426-1656 or
fax 206-944-7556.



Larsen Antennas
The Clear Choice™



Circle (92) on Fast Fact Card

P eople



Weiss



Coryelle



Mramor



Brown

Jamie P. McConaty, manager of global systems and product development for Ericsson GE, Lynchburg, VA, advances to vice president for the North American region.

John Weiss, associate sales manager for Newmar, Newport Beach, CA, advances to national sales manager.

Thomas E. Wanley leaves the staff of Rep. Philip R. Sharp of Indiana as legislative director to join Telocator, Washington, DC, as director of government relations.

Robert P. Denaro departs Trimble Navigation, Sunnyvale, CA, as vice president and manager of the vehicle tracking and navigation systems division to join Motorola, Northbrook, IL, as director of its position and navigation systems business.

Jim Coryelle leaves Telewave, Mountain View, CA, as sales engineer to join Wallace and Wallace, Santa Fe Springs, CA, as a field representative.

Changes at Antenna Specialists, (A/S) Cleveland:

Charles Mramor exits Jet, Cleveland, as customer service supervisor to become customer service manager for A/S.

Michele Brown, A/S customer service representative, advances to international sales administrator.

The Radio Club of America has elevated the following individuals to the membership status of Fellow:

Linda D. "Lin" Ford, historian, Associated Public-Safety Communications Officers, South Daytona, FL; telecommunicator, Greensboro Police Dept. (retired); adviser for the North Carolina Division of Emergency Management ESD Division, Greensboro, NC.

Robert W. Galvin, chairman of the executive committee of the board, Motorola, Schaumburg, IL.

Raymond Minichiello, P.E., president, Lapp, Manchester, NH.

Ronald J. Jakubowski, system engineering manager, Antenna Specialists, Cleveland.

Ake S. Persson, vice president of business development, Ericsson GE Mobile Communications, Research Triangle Park, NC.

John S. Powell, president, Associated Public-Safety Communications Officers, South Daytona, FL; sergeant with University of California Police Dept., Berkeley, CA.; and communications coordinator for University of California Police System.

Willard K. Shaw, owner, California Trunking, Vista, CA.

Mobile Radio Technology

The journal of mobile communications technology

BUSINESS

Cameron Bishop, *Group Vice President*
Mercy Contreras, *Publisher*
Darren Sextro, *Marketing Director*
Kathryn Buckley, *Promotions Manager*
Denise Kettler, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Mary Birnbaum, *Advertising Production Supervisor*
Liz Turner, *Advertising Coordinator*
Tammy Kalebaugh, *Classified Advertising Coordinator*
Tom Cook, *Group Senior Managing Editor*
Doug Conrod, *Corporate Art Director*
Stephanie Hanaway, *Group Director of Special Projects*

Harry A. McQuillen, *President and CEO*
Raymond E. Maloney, *Executive Vice President*
Sandra Milan, *Corporate Circulation Director*
Michele Bartlett, *Circulation Director*
Larry Gorsuch, *Circulation Coordinator*
Customer Service, 800-441-0294

ADVERTISING SALES OFFICES:

ENGLEWOOD, COLORADO

Ruth Breashears, *Northeast region (CT, Eastern Canada, MA, MD, NH, NJ, NY, OH, PA)*
Carla M. Gamino, *Southeast region (AL, AR, FL, GA, MO, MS, NC, OK, SC, TN, VA)*
Diane Hite, *Midwest/Southwest region (AZ, CO, KS, LA, MT, NE, NM, NV, TX, UT, WY)*
Mercy Contreras, *Publisher*
333 W. Hampden Ave., Suite 803
Englewood, CO 80110
Phone: 303-762-1249
Fax: 303-762-0069

SAN RAFAEL, CALIFORNIA

Dennis Hegg, *West region (AK, CA, OR, WA, Western Canada)*
950 N. Gate Drive, Suite 207
San Rafael, CA 94903
Phone: 415-491-1442
Fax: 415-491-1842

CHICAGO

Janet Blaney, *East Central region (IA, IL, IN, MI, MN, WI)*
55 E. Jackson, Suite 1100
Chicago, IL 60604
Phone: 312-435-2340
Fax: 312-922-1408

OXFORD, ENGLAND

Richard Woolley
Unit 3, Castle Farm Business Centre, Clifton Road
Deddington, Oxford, OX15 4TP, United Kingdom
Phone: +44 (0)869 38794
Fax: +44 (0)869 38040

CLASSIFIEDS

Joyce Bollegar
9800 Metcalf Ave.
Overland Park, KS 66212-2215
Phone: 913-967-1923
Fax: 913-967-1901

LIST RENTAL SERVICES REPRESENTATIVE

Greg Hembree
9800 Metcalf Ave.
Overland Park, KS 66212-2215
Phone: 913-967-1872
Fax: 913-967-1897

L etters to the editor

Directional wattmeters:

I would like to make some specific comments on the article "Mobile, Portable, Base Station Cellular Telephone Antennas" by Roald Steen in the February edition.

Mr. Steen discusses in some detail the importance of using a directional wattmeter when installing a transmitting antenna. This advice is somewhat outdated.

The directional wattmeter is a technology that dates to the '40s and '50s and was intended to solve the problems found in transmitters with vacuum tube final amplifiers, operating at frequencies below about 50MHz, and with tunable pi-nets or I-net matching networks.

These transmitter networks and their accompanying antennas usually had to be manually retuned if the operating frequency was changed even slightly. Today's radios are much different!

Let's take a quick look at the situations commonly encountered today, that the directional wattmeter is a poor choice to handle:

- (1) The same antenna is used for transmitting and receiving, and the transmitter cannot be tuned to the receive frequency.
- (2) Systems in which the antenna is shared, through a network of isolators, combiners, and cavity filters, among a number of transceivers.
- (3) Data links where the transmitter is operated in bursts.
- (4) Where moisture and contamination have entered the antenna or transmission line and have increased the system losses.
- (5) Control over the radiation pattern is important to the performance of the system.
- (6) Environmental factors require that the antenna be tuned at the installation site.
- (7) Systems using a wideband technology, like television or spread-spectrum.
- (8) Where the manufacturer has included power losses to make the antenna appear as a good VSWR match.
- (9) Certifying that coaxial cable runs are free of faults and kinks and that connectors have been properly installed.

(10) Anywhere that a transmitter is unavailable for testing, or where powerful transmitter operation, even for short time periods, is not an available choice.

That the directional wattmeter is still used at all is more a tribute to the stubbornness of technicians and their technical schools than it is to the versatility of the instrument.

Everywhere I go, I see the efforts of engineers and technicians to "kluge" over the wattmeter's shortcomings: special slugs for low power or peak power; wattmeters with band switches; technicians

who put power amplifiers on signal generators so they can use the wattmeter off-frequency; special programmed chips for transceivers to tune more frequencies; costly accessories for spectrum analyzers; custom computer interfaces; and installations with 10 or 20 or even more directional wattmeters permanently left in-line.

The instrument that can do all these things is the RF network analyzer. Just as radio technology changes, so do instrumentation requirements.

Because the network analyzer can be used in a much wider range of situations and can solve a much greater range of problems, it is replacing the directional wattmeter as the instrument of choice for installing and maintaining cellular telephone antennas and two-way radio antenna systems.

Wayne R. Openlander
Chairman
Direct Conversion Technique
Chicago

Fast Fact Card comments:

The two toughest problems facing me on the job are:

- troubleshooting surface-mount devices (SMDs) on printed circuit boards where the SMDs are on the chassis side of the board, as well as the visible side.
- bad schematics with inadequate information.

Richard J. Wolf
Lead Technician
Radicom
McHenry, IL

The two toughest problems facing me on the job are:

- a lack of awareness in some quarters about automobile electrical noise sources that affect communication performance.
- a lack of standards from vehicle manufacturers about electrical noise.

Jaime G. Arevalo
RF Design Engineer
Uniden
Fort Worth, TX

The two toughest problems facing me on the job are:

- finding reliable radio equipment at an affordable price.
- obtaining new frequencies in crowded areas.

Dana V. Archer
Communication Officer
California State University
Police Department
Northridge, CA

TCS

Jerry L. Simmons

Communications Systems Consulting
Land Mobile & Microwave Systems

P.O. Box 884 Ph (409) 588-3200
Montgomery, TX 77356 Fax (409) 588-4434



FREDERICK G. GRIFFIN, P.C.
3229 WATERLICK ROAD
LYNCHBURG, VA 24502
TEL: (804)237-2044 / FAX: (804)237-6063

NATIONWIDE COMMUNICATIONS CONSULTING
MOBILE RADIO, MICROWAVE, E9-1-1
CAD, PAGING, LAN
DISPATCH COMMUNICATIONS CENTERS
MULTI SITE PROPAGATION ANALYSIS

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936



MOTOROLA
Depot Quality
Nationwide Repair

New Expanded Facility
Factory Trained Technicians

Flat Labor Rates - Plus Parts
Maintenance Contracts Also Available
Fast Turn Around via UPS - Parts Return - Warranty

Portacom, Inc. (813)997-2299
Authorized Motorola Dealer
583-G Pondella Rd., North Ft. Myers, FL 33903



RAYMOND C. TROTT
CONSULTING ENGINEERS, INC.
1425 GREENWAY DRIVE, SUITE 350
IRVING, TEXAS 75038
214/580-1911

RAYMOND C. TROTT, P.E.
PRESIDENT

LAND MOBILE / MICROWAVE COMMUNICATIONS SYSTEMS

SFA INC.

(301) 925-9400
(800) 288-1-SFA
Fax (301) 925-8612

**Telecommunication & Information
Science Division**

Public Safety, Transit, Government & Industry

CORPORATE OFFICE

Robert Fier 1401 McCormick Drive
Manager Landover, Maryland 20785

Communications Technology Associates
A division of Hayes, Seay, Mattern & Mattern, Inc.

- PLANNING AND DESIGN:**
- 2-Way Radio
 - MW & F/O
 - CAD/MDT/AVL/Paging
- PLUS:**
- Complete A&E Services
 - Bldgs, Towers, Pwr Sys
 - Structural Engineering



Box (804) 239-9200 FAX (804) 239-9221
P.O. Box 4529 Lynchburg, Virginia 24572

The Warner Group
MANAGEMENT CONSULTANTS

- Radio/Microwave/E9-1-1
- D P Design and Selection
- Police/Fire/EMS
- Consolidation Studies

5850 CANOGA AVENUE, SUITE 600
WOODLAND HILLS, CALIF. 91367
(818) 710-8855

THE PORTABLE DEPOT, Inc.
SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE

- FACTORY TRAINED TECHNICIANS
 - SURFACE MOUNT TECHNOLOGY
 - FACTORY APPROVED NATIONWIDE
 - PUBLIC SERVICE TRUNKING
 - VOICE GUARD CERTIFIED
 - MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS
- Route 2, Box 338C • Lynchburg VA 24501
804-237-3427

PORTA-TECH

**PORTABLE
TECHNICAL
SERVICE, INC.**

121 Crowell Lane • Lynchburg, VA 24502



FACTORY TRAINED
TECHNICIANS
FOR QUALITY SERVICE

GE Portable Radio Service Depot
Factory Approved Nationwide

- Current Product Lines
- Voice Guard Certified
- Public Service Trunking
- Surface Mount Technology

(804) 239-3049

HERB SACHS, CONSULTING

Specialist in Public Safety Communications

P.O. Box 729
Bowie, MD 20715
301-464-4268

**Professional
Consulting Services**

Equipment for Sale

MIDLAND LMR

LAND MOBILE RADIO Nationwide

**Factory Approved
WHOLESALE PRICES**

- Large Inventory • Fast Service • Flat Rate Repair Service
- Complete Dealer Support Program

All Dealer Inquiries
Welcome

(800) 726-9015
(612) 884-8352

SAME DAY SHIPPING

Call for Weekly Specials!

Refurbished Equipment Available
Wholesale Prices to Dealers Only.

FAX (612) 884-8356

RGW

DISTRIBUTING

9635 Girard Ave. South
Bloomington, MN 55431

**COMMUNICATIONS
CONSULTING SERVICES**

- ☑ Mobile Radio Systems
- ☑ Mobile/Portable Data Systems
- ☑ Computer Aided Dispatch Systems
- ☑ Basic And Enhanced 9-1-1 Systems
- ☑ Telephone Networks
- ☑ Microwave Radio Systems
- ☑ Vehicle Location Systems
- ☑ Fiber Optic/PCM Transmission Systems

PLANNING, DESIGN, IMPLEMENTATION

RAM

10 Woodbridge Center Drive
Woodbridge, NJ 07095
(908) 636-6970
Toll-Free: (800) 247-4796 • FAX: (908) 636-7260

**COMMUNICATIONS
CONSULTANTS, INC.**

Offices throughout the United States and London, England;
Melbourne, Australia; Richmond, B.C. Canada.

STAND-BY DIESEL GENERATORS HIGHWAY TRAILER MOUNTED

2 EACH: KUBOTA POWERED 15 KW CONTINUOUS OUTPUT.
120/240 - 120/208 - 277/480 VOLTS A.C. 60 HZ.
SELECTABLE SINGLE OR THREE PHASE. 7600/8800 HOURS
EXCELLENT CONDITION \$6,500.00 EACH
F.O.B. NAPERVILLE, IL

4 EACH: DEUTZ POWERED BURCO 15 KW CONTINUOUS OUTPUT
120/240 - 120/208 - 277/480 VOLTS A.C. 60 HZ.
SIMULTANEOUS SINGLE AND THREE PHASE WITH DISTRIBUTION BOX.
FULLY CAGE ENCLOSED WITH LIFTING EYE. EXCELLENT CONDITION.
ALL HAVE LESS THAN 100 HOURS!
REPLACEMENT COST - \$14,247.00 \$6,950.00 EACH
F.O.B. NAPERVILLE, IL

CELLULAR COMMUNICATIONS CORPORATION
WILLIAM W. EDELSTEIN • (708) 420-0000

C lassified

Advertising rates in **Mobile Radio Technology's** Classified Section are \$69.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4 inch.

Blind box ads (replies sent to MRT for forwarding) are \$30.00 and Fast Fact reader service numbers are available for \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by MRT on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Joyce Bollegar at (913) 967-1927 or fax (913) 967-1901 to place your classified ad. Or send your advertising materials and order to Tammy Kalebough, **Mobile Radio Technology**, Classified Advertising Department, 9800 Metcalf, Overland Park, KS 66212.

CELLULAR TWO-WAY PAGING PERSONNEL SERVICES

- Executive • Management • Marketing
- Sales • Engineers • Technicians

Fees client paid. Send resume to address below

PERMANENT & CONTRACT PERSONNEL AVAILABLE

- Extensive national resource of personnel
- Reasonable fees

Employers: Call 606-491-5410 10 AM to 8 PM



Communication Resources

P.O. Box 141397 • Cincinnati, OH 45250

606-491-5410/FAX 606-491-4340

Rentals

MOTOROLA

RENTALS

- GP300, P200, HT600
- Mobiles, Repeaters
- Intrinsically Safe
- Dealers Welcome

1-800-822-MOSS

MOSS
COMMUNICATIONS

Help wanted

TECHNICIAN WANTED

TO WORK IN NO. CALIFORNIA

Motorola Experience Preferred,

Naber or FCC Licensed.

Benefit Package, Retirement.

CALL OR SEND RESUME TO:

MASTERSON COMMUNICATIONS

2030 A INDUSTRY ROAD, UKIAH, CA 95482

(707) 462-9736

TWO-WAY TECHNICIAN WANTED TWO-WAY SALESPERSON WANTED

GE Premier Dealer serving the Chicagoland area for over 35 years is seeking an experienced GE/Motorola bench and field technician. Also seeking motivated, experienced salesperson. Send resume and salary requirements.

Personnel Dept.
1758 Taft Ave.
Berkeley, IL 60163

CAREER SEARCH? We have the opportunities!

Cellular / Wireless / PCS / Radio

Permanent & Consulting • Domestic & International

E. J. DORT & ASSOCIATES

P.O. Box 12546 • RTP, NC 27709-2546

919-544-9476

Situation wanted

SITUATION WANTED

Ex-Motorola Service Manager with 14 years experience in CDSC Service Center is seeking a management position. Formal electronics training and FCC/Naber's licensed. Operated one of the best P&L's in my division (3 years straight). Full working knowledge of all Motorola product lines from Motrac mobiles to trunked SmartNet systems. If you are interested in making a profit while maintaining total customer satisfaction, please leave message for Bobby Thompson, Jr. at 1-214-278-8584.

Business opportunities

For Sale 2-Way Radio Business

PROFITABLE, well-established small SMR, Paging & UHF repeater business in Southeastern Pennsylvania with a stable base of 400 customers. Excellent growth potential. Operating from six, well equipped tower sites, yearly billings \$150,000, five-year net cash flow \$400,000. All FCC licenses go with the sale. Reasonable asking price and terms. Forced retirement.

717-394-1180

SUNNY SOUTHERN CALIFORNIA

Two-Way radio repair business.

Established in 1979.

Great customer base, service contracts.

805-254-3582

Services



DUPLETUNE
303 FRHS RD
TONAWANDA, NY 14150
716-834-2787

REPAIR & RETUNING
OF
DUPLEXERS
Filter Systems
Rx Multicouplers

Retired Motorola Bench Tech.

REPAIR HAM GEAR
KENWOOD, YAESU, ICOM, TENCET

TOM MILLER ELECTRONICS K6RXX

22516 S. Normandie Sp. 41B

Torrance, CA 90502

REPAIR SPEAKER MIKES
For Motorola Portables

(310) 320-8980
(800) 995-8964

STUDY LAND MOBILE COMMUNICATIONS AT HOME!

38 lessons written exclusively for Mobile Communications Servicing. \$375.00. Call or write for free information:



P.O. Box 8278
Lumberton, TX 77711-0278
(409) 755-7838

FCC License Preparation

Fast, Easy, Home Study, Inexpensive.
Land Mobile Handbook, New Employment Guide.
Audio & Video Courses Available.

General Radio Telephone License.
WPT PUBLICATIONS

1-800-800-7588

FREE Details

Buy and sell

BUY & SELL

**ALL MANUFACTURERS
ALL BRANDS**

Call Brian Johnston

404-434-5949

Growing Motorola service shop in beautiful Northern Nevada needs qualified and experienced two way radio technicians. Minimum 2 years experience servicing major brands. Must have strong employment history and FCC license. Excellent wages & benefits. Send resume to:

WESTERN COMM

688 Idaho St., Elko, NV 89801

Attn: Roger Finn

TWO-WAY RADIO TECHNICIAN

Growing dealer in N.E. Wisconsin, seeks experienced two-way radio technician. Minimum 3 years experience. Excellent wages and fringe benefits. Send to: ATTN: MRT, Dept #927, 9800 Metcalf, Overland Park, KS 66212.

Equipment for sale

BUY & SELL

Used GE-MARC
Trunking Radios.

TMX 8310 TMX 8210
TMX 8510 TMX 8712
TMX 8825 TMX 8615

Call John Peacock

Tel. 800-232-7715

Fax 501-735-7799

AF Antenna Farm Communications Supply

ANDREW



In Kansas
913-492-6212

DECEBEL



ES



Call for a copy of our Price Book!

1-800-255-6222

FAX
913-492-2948

Circle (100) on Fast Fact Card

MECHEM ELECTRONICS

P. O. Box 7846

Fredericksburg, VA 22404

(703) 373-3888

Mailing Address:
P. O. Box 7846
Fredericksburg, VA 22404
1003A Tyler Street
Fredericksburg, VA 22401

Synlor X

T73VBJ7204AK-150-174, 8M, 100W, Sys 90 Access.
T73VXJ7204AK-150-174, 8M, 100W, DES Hi Sec. Housing
T74VBJ7D04BK-406-430, 16M, 100W
T74VBJ7D04BK-450-470, 16M, 100W, Syst. 90 Access.

Synlor

T83SRA3800-150-162, 162-174, 12F, 100W
T44, 64, 74SRA3200-403-430, PL, 8F
T44SRA3800BK-450-470, 12F, 50W, Sys. 90 Access
T44SRA3200BK-482-512, 8F, 50W, Sys. 90/Scan Access

MCX100

MBD23EXA7J00AK-150-174, 10W, 32F, DualPri, ScanDES
MET44EXAJ00BK-403-430, 30W, DES

MCX1000

MBT44LXA7H00AK-403-430, 30W, DES, T/R Only

Milreks

T51JJA1000AK-29, 7-38, 999, 60W, CS4F

T43, 53, 83JJA1000-148-174, 4F, CS & PL

T64JJA3100-450-470, 75W, PL, 4F

T45JJA6000AK-800MC, 35W, 4F

PAC RTs

H14TTY3110-450-470MC

GE

MC74AAS32A-36-42, 100W

MC74CCS66A-150-174, 100W

EX76CCS66A-150-174, 100W & Auxiliary RX

We have the R1801 DAC for your programming needs. Call us with your requests.

Phone: (703) 373-3888

We accept VISA and Mastercard

Fax: (703) 786-7968

Circle (101) on Fast Fact Card

Used Motorola Starplex Modems. Also MR200 Microwave. Hot Standby. Includes 8 ft. dishes. Freq. 1.9 gig.

Call 801-789-6947

ICOM

ICOM Factory Authorized Sales & Service
Radios & accessories bought, sold and repaired.
Warranty Service Center. Dealers Welcome. Land
Mobile & receivers only (no marine or amateur).

SWS SECURITY 1-800-776-8274

"Find Out What Everyone Is Talking About!"

ANTENEX
2000-209 Bloomingdale Road, Glendale, IL U.S.A.

Call or write for complete catalog on
ANTENEX mobile, portable, and
base antennas, mounts, cable,
connectors, and accessories!

Summer
1992

ANTENEX

?

WHOLESALE CATALOG AND PRICE LIST

Order: 800-323-3757

Fax: 800-851-9009

COOK'S COMMUNICATIONS

GE

LTR

160 N. Broadway
Fresno, CA 93701

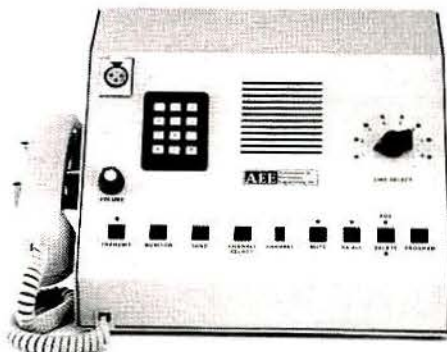
VISA
MASTERCARD

MOBILE AND PORTABLE RADIOS AT
WHOLESALE PRICES

1-800-233-8818



**Simple,
Reliable, Tone
Remote Control**



**Automation &
Electronics
Engineering, Inc.**

13667 Floyd Circle • Dallas, Texas 75243
1-800-527-4596

Circle (102) on Fast Fact Card

WHY PAY MORE!

AIR COMM FURNISHES QUALITY — PRICE — SELECTION — DELIVERY

RECENT SYSTEM ARRIVALS

MDC 4800 Signalling System Consisting of:	
MOT "MSF500" 75W analog (digital capable) duplex base stn. (C65CLB7206)—possible purc/trnking use (Qty. 18)	\$4500
"GCC480" gen'l comm. controller (D2007AG)	
E/W UDS 201 B/AT 4W modem (2DN6426)	\$800
DB prod. 4-cavity B/P dplx (SP8303)	\$400
RDX Portable Data Systems (1 New, 1-USED) consisting of:	
MOT "Micor" 2-12W base st., c/s	
(C24RCB105-SP390)	\$1200/900
MOT 2-cavity dplx (T1503)	\$200/150
MOT RDX1100 control unit (N12596)	\$600/300
MOT RDX100 portable RF data terminal (N1257A) w/o N.Cd	\$100/50
MOT spare circuit box (NLN5074)	Offer
NOTE: System is compatible w/IBM 3270 info dis. sys.	
450MHz Paging System, TAV. (453-125MHz) consisting of:	
MOT "Micor" 250W base stn. PL, DC (B84RCB1105)	\$2600
MOT "Modax 500" w/U.N.I. (E08/DS1000)	\$500
MOT (200) "Sprint" pagers w/o batt. cover, filters, chgr.	\$25
TOTAL SYSTEM PRICE: \$3500	

BASE STATIONS

MOT "Micor" 450MHz, 250W, C/S, DC (B84RCB)	\$2600
MOT "Micor" 450MHz, 2-12W PL (C24RCB)	\$1000
MOT "Micor" 150MHz, 250W, PL, DC (B83RCB)	\$2600
MOT "Micor" 162MHz, 100W, C/S, DC (C73RCB)	\$1200
MOT "Micor" 72MHz, 30W, PL (C42RCB)	\$1000/1200
MOT "Micor" 30MHz, 100W, PL, DC (C71RTB)	\$1000
MOT "Micor" 25-30MHz, 100W P.A. only (TLB1411)	New \$300
GE "Mastr II" 150MHz, 250W, w/c R/cvr (VC96RAS)	\$1700
Quintron 150MHz, 250W, paging XMTR (QT300A), needs repair	\$700
MOT "Mitrek/M-70" super consolette base	Call
MOT "M-70" 150MHz, 45W, 4F, PL, "SP" (L53BBB)	\$200
GE "Royal Exec"; 150/450MHz CL S.S.	\$100

MOBILES

MOT "Spectra" 900MHz 12W (D27KMA—B7/B5/B2)	\$400
MOT "Maxtrac" 12W (D27MWA—B6)	\$400
MOT "PP500/PP1000" 800MHz (T35JA/SA505/16) w/o acc'y	\$150
As Above w/acc'y	Call
MOT "Mostar" 800MHz 15W 1-SYS (D35TLA)	\$275
MOT "Traxar" 800MHz 10W 1-SYS (D25TDA)	\$225
MOT "Mitrek" 450MHz 100W, PL/DPL (T74JJA)	\$400
MOT "Syntor-X" 450/150MHz, 100W, 8F w/acc'y	\$550
MOT "Syntor-X" 150MHz, 100W, 16F, 8F scan w/rear control	\$600
MOT "Mitrek" 40-50MHz, 50W, C/S w/o TCXO/Acc'y's	\$75
As above w/o BTM cover	\$60
GE "MVS" 450MHz 25W, 2F	\$250

MOBILE ACCESSORIES

MOT "Syntor-X9000" Control Hd. (HCN1032) TRNKD (early)	\$35
MOT "Syntor-X9000" Control Hd. (HCN1063) 32F conv	\$50
MOT "Syntor-X9000" Control Hd. (HCN1065) TRND (late)	\$50
MOT "Syntor-X9000" Control Hd. (HCN1073) 32F Conv.	\$50
MOT "Meratrac" 99F control hd (HCN1052)	\$50
"SSM" units: TLN 157/13042, HLN 1198/1225/1241/1300	1/3 NSO
MOT "Syntor" 1/4F control Hd. (HCN1004/5)	\$35/40
MOT "Spectra" MIC (HMM1061)	\$35
As above noise cancelling (TNN6123)	New \$35
MOT SYS 90" housing, ivory (TNN6123)	New \$3
MOT C/COM 12W ampl. spkr w/power cord (NSH 6027)	\$25
MOT "Maxar-50" hang up box (TRN4655)	New \$3
MOT "Micor" "Mitrek", "M-70" top/bottom covers	Call
MOT mobile cables "Syntor-X" "Micor/Syntor" "M-70" Mitrek	Call
MOT "Pulsar II" IMTS Accessories	Call
MOT "Siren" 50W w/PA (N1300) w/o spkr	\$50
MOT "PAC/RT" 150/450MHz rpt., w/o cable	\$300
MOT nameplate "Syntor-X", "Syntor X2/X3", Syntor, "M10R", "M-70"	\$2-5
"M-35" "Motrac", MX Series, MT500 Series, HT220 Series, etc.	Call
GE "Delta" 5W MVB spkr (19C8505567)	New \$12
As above, Qty. 6 or more	\$10

PORTABLE RADIOS

MOT "MTX900" 900MHz, 2W trnk/conv w/charger	Call
MOT "MTX800" series 800MHz, 2W trnk/conv, w/charger	Call
MOT "HT600/P200" 150/450MHz	Call
MOT "GP300/P110" 150/450MHz	Call

UNIT PRICE

MOT "P100" 403-430MHz, 495-500MHz, 4W 2/6F w/acc'y	New \$300
MOT "P100" 162-174MHz 5W, 2F w/acc'y	New \$270
MOT "MX340S" 150MHz, 6W, 4F, PL w/o prum/batt	\$150
MOT "MX360" 150MHz 6F, 8F, PL	\$100
MOT "MT500" 450MHz 6F, 8F, PL	\$150
MOT "EXPO" 450MHz, 1W, C/S-PL/DPL	\$100
MOT "MT500" 136-150MHz, 162-174MHz, 2W, 1F, C/S	\$50
MOT "HT220" 450MHz 4W 1F, PL remote only	\$30
As above w/spkr/mic	\$40
MOT "HT220" c/comm 4W, 4F, PL	\$50
GE "MPI" 150MHz, 4W, 2F, CG	\$100
MOT "PT500" 150MHz, 5W, 8F, C/S w/alk. batt. pack	\$125

PORTABLE RADIO ACCESSORIES

MOT "GP300/P110" 6-unit rapid charger (HTN9748)	\$250
As above w/bd power supply	\$150
MOT "GP300/P110" 1-unit rapid charger (HTN9030)	\$32
MOT "GP300/P110" spkr/mic (HMM9725) "B" model	\$35
As above—"C" model	\$40
MOT "GP300" carry holster (HLN9749)	New \$10
MOT "P100/HT90" 1-unit rapid charger (NTN4684)	\$30/35
MOT "HT600/P200" 1-unit, rapid charger (NTN4633)	\$35
MOT "P50/HT10" 1-unit, rapid charger (HTN9026)	\$25
MOT "P50/HT10" 16hr, rapid charger (HTN9046)	\$10
MOT "MX/STX" 1-unit rapid charger (NLN8858)	\$70
MOT "MT500" 1-unit, rapid Omni charger (NLN4569)	\$65
MOT "Handle Comm" 1-unit, 16hr charger (NLN8005)	\$25
MOT "MX/STX" 6-unit, rapid charger (NLN8898)	\$175
MOT "Saber/HT600/Expo" 6-unit, rapid charger	Call
MOT "P100/HT50" 6-unit, rapid charger	\$175
MOT "P100/HT50" compact charger (NTN4881)	New \$10
MOT "P100/HT50" 450MHz antenna (NAE5483)	New \$3-50
As above	12 for \$36
MOT "HT600/P200" spkr/mic (NMN6127/53/56)	\$40
MOT MacDonald type (SIM to P50) hdset w/o vol	New \$20
MOT "GP300/P110" 16F Escutcheon	New \$5

LOCAL/REMOTE CONSOLE/DESK SETS

MOT "T1617" series 4/6 ch. dc remote	\$800/1,000
MOT "T1602" dc remote console w/desk mic	\$250
MOT "T1375/77/80" dc remote handset	\$125
MOT "Series 90" dc remote cons.	
(T1901/T1902/1881/1882)	new/used \$150/125
As above T188/1902	NEED REPAIR \$40
MOT T1903 "Series 90" local console	new/used \$100/75
Misc. DC handsets, SECODE-M-70, SSC-811FY234.	
IDA24-10, Comm Prod. RD11-8	\$75
MOT "T1383" tone remote desk set	new/used \$100
MOT "T1926" "Series 90" tone remote console	\$125
Misc. tone handsets: Secode-M-80, Comm. Prod. RT32	\$75
SSC tone remote adaptor Bo. (832AY)	\$60
Calgary DC remote adaptor Bo. (648B)	\$45
GE base mic, New style (19C5806P16)	New \$45
Misc. Manual phone patch—MOT-B1203, SYT-12/240 (New), Data Sig.—RAP400, Trac III (New), SYT850	\$50
MOT "RAX4020" overvoltage protector (OEM TH1416)	New \$20
GE "Mastr" dc controller, CG, DTMF enc. w/desk mic (539A2S1)	\$90
GE "Mastr" local controller, 2F, CG, w/desk mic (659A2S2)	\$50

POWER SUPPLIES

MOT HPN1001/HPN1007/TPN1136, 7A, 12VDC	\$75
MOT HPN3196/HPN1008/TPN1154, 10A, 12VDC	\$95
MOT "Mitrek" console low power A.C. (NPN1002)	New \$100
GE "Mastr II" base station, 100W, 30A (19D430272G1)	\$175
GE "Phoenix" 10A (19D430175G1)	\$60
GE "Pro" base station (4EP39A12)	100
GE "Pro" receiver only (4EP39A12)	\$50
Above w/VHF or UHF receiver	\$70
FADACS P/N DCS-12-10S, 10A, 12VDC	\$50
GLENAYRE M2803, DC-DC convertor, 48VDC in, 13-6VDC, 12A	\$50
MOT "Micor", "Syntor-X" console chassis w/o P.S./cover	Offer
ASTRON "RS-12A" 12A, 12VDC	\$60

CAVITY-DUPLEXERS ETC.

WACOM 150MHz Dplx (WP420-2)	New \$250
WACOM 150MHz notch filter (WP539-1), 162MHz	\$125
WACOM 133MHz B/P cavity (WP428), 134MHz	\$125
Sinclair R2B13C dplx, 143/148MHz	\$200
Sinclair R217C dplx, 164/159MHz	\$200
RJ Comm. RMG 150-116R 150MHz, 12-Multi-C	\$125
MOT "T1504" 450MHz, B/R dplx	\$325

CTS/PAGING REEDS AND ACTIVE FILTERS

MOT "PL" Reed (TLN6824/KLN6210) Sender	\$15
MOT "PL" Reed (TLN8381) Sponder	\$15
MOT "PL" Reed (TLN6709/KLN6209) Sponder	\$15
MOT "PL" Reed (TU217/233) Sender/Sponder (Copper Type)	\$15
MOT "PL" Filter (NFN6010) "MX/MT500/HT90"	\$25
MOT "PL" Filter (NFN6016) "EXP0"	\$15
MOT "PL" Code Plug (TRN4224)	
"MAXAR/MITREK/SYNTRON"	\$12
MOT DPL Code Plug (TRN6005)	
"MAXAR/MICOR/SYNTRON"	\$12
As above, "PL" and "DPL" Code Plug Blanks w/instruc.	\$6/9
MOT DPL Filter (NLN8922) "MX"	\$15
MOT DPL Filter (NLN5762) "MT500"	\$15
GE CG Red Network (19B2052606)	\$25
GE CG "VERSATONE" (19C32020TG)	\$12
GE CG Enc/Decoder Reeds (Mid. by Bramco)	\$15
MOT "OCI" or "OCII" filter (NLN8503/7834)	
"PBVI/SPIRIT"	\$15
MOT "OCI" or "OCII" Reed (KLN6202)	
"PAGECOM/DIRECTOR"	\$12
Sponder	
MOT "OCI" or "OCII" Reed (TLN6709/KLN6209)	\$15
Sender	
MOT "OCI" or "OCII" Reed (TLN6824/KLN6210)	\$15
NOTE: We Stock MOT, GE/ELECTRON/FEDERAL NON-STD. CODES FOR "PL" "WCI" "OCII" Systems	

CHANNEL ELEMENTS/TCXO

We stock a wide selection of TCXOs for most MOT/GE/RCA Mobiles/Base Stations/Portables. Price vary from \$5 to \$20

MX SERIES MODULES

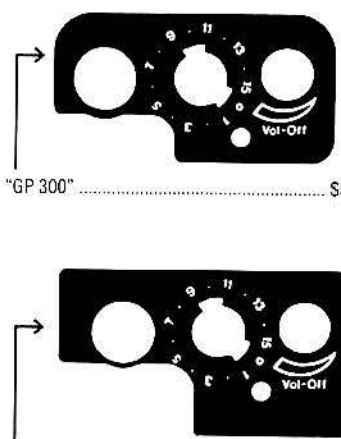
We stock a complete selection of VHF, UHF, 800MHz, modules. Prices are 25-33% of original cost

MOTOROLA COMPATIBLE PROGRAMMING SYSTEM

COMPUTER INTERFACE BOX - includes AC Power Supply & XT or AT Cable	\$90
AS ABOVE w/N.Cd (For Portable Use)	\$110
RADIO INTERFACE CABLE "HT600/M1000/P200"	\$65
"HT50/P100"	\$80
"MAX TRAC/M100/M400"	\$35
"SABER"	\$125
"STX"	\$35
"P110/GP300"	\$90
"HT1000/MT200/MTX8000"	\$90
"SPECTRA" (Low Power)	\$50

ESCUTCHEONS

"GP300"	\$5
"GP110"	\$5



"GP 110" \$5

AIR COMM

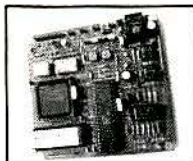
TWO-WAY RADIO SALES

CALL FOR LOWEST PRICES • (602) 275-4505 • FAX(602) 275-4555

WE STOCK "PL", PAGING REEDS, AND CHANNEL ELEMENTS

4614 E. McDOWELL RD.—PHOENIX, AZ 85008

Natural Voice Playback



- Repeater Identifiers
- Site Alarms
- Remote Telemetry
- Weather Stations
- Multiple Languages
- Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies consisting of over 100 words or multiple phrases up to 1 minute in a *Natural Voice* is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

Parallel input word select
500 ma keyline output
32 Kb sampling rate
Multiple modes
Selectable timing

8 ohm Audio output
600 ohm Audio output
+9v to +14v supply
Size: 4.00" x 4.25"
Connectors included

Several different models available

Palomar Telecom, Inc.

1201 Simpson Way, Escondido, Ca. 92029

(619) 746-7998 • Fax (619) 746-1610

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

ALPHA NUMERIC
DISPLAY PAGERS

BRAVO ALPHA

PMR 2000

IDP 7000

FOURTH DIMENSION INDUSTRY, INC.

WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER

330G Duane Court, Bellerose, New York 11711

516/677-1221
Fax 516/677-1227

PAGERS FOR SALE

★★ TECH-NET BBS ★★

Commercial Two-Way Radio BBS for Buy-Sale of Radio Equipment. Over 800 megs of files on the BBS. There is also a Ham Radio Callbook Database on-line. BBS is 1200-14,400 bps 8N1. BBS is FREE to all Commercial 2-way Radio Techs and Dealers. Log-on and join hundreds of other callers.

Call the Tech-Net BBS (615) 586-4913.

LTR REPEATER

150 Watt. Never Used. Will sell at dealer cost. Ready for shipment today.

1-(704) 847-0612

Ask for Hollis or Jack.

Equipment for sale



TRIPLETT CORPORATION
Quality and Technology for Tomorrow



1993 Software Version 3.012! Call for Current Pricing!

NEW Features for Triplett 5000E:

- Power Test on 1 or 3 Channels
- Extended Test Mode Option to test the earpiece and microphone
- Three memory locations for storing test results
- Test data can be displayed in dBm or Watts
- Software updates via the RS-232 port

distributed by
Communications Associates Inc.

(800) 435-9313

In Illinois (800) 892-1611

Order Fax (800) 284-4934

Circle (104) on Fast Fact Card

TRADE

BUY

PCI — PEKAAR COMMUNICATION INC.
Steve's back, formerly of Gregory Electronics Corp.
\$ Specials of the month. \$

GE S990 Control Head 128 channel	NEW \$75
GE MPD PLS Letter Carrying Case, NEW, Large or Short Style with Strap Only	\$15
Motrola Maratrac Model TB1XTA7TATAK 100W 36-42 range less accessories	\$400
Motrola Mitrac Model T51JJA 2900 60 watt 42-50 range 4 freq. with accessories, clean, no PL	\$150
Motrola MOCOM 70 U41BBA 1900 60 watt 42-50 range 4 freq. w/access. clean, no PL	\$95
Motrola Remote T1370 Telephone type	\$75
Motrola Remote T1600 Telephone with Handset	\$175
Motrola Remote T1503 CA Series 90	\$50
GE MPD Portable 450 to 470 range wiscan, Special	\$350
GE MPE Portable Model P665RBWBMX 450 to 470 range, 2 freq. w/CG	\$85
GE MPE Portables Model P665RBW 450 to 470 range, 2 freq. w/CG	\$75
GE MPE 10 Unit Rack Charger Model 362L3C1X	\$75
Regency BTH201 HB w/accessories	\$45
Regency Model TR201 HB w/accessories	\$75
GE PE Portables-Most ranges T.S. AS IS, WITH ICOMS.	\$25

Catalog Available *If you can't find it, try us!* Call (201) 772-0704

SELL

GE

MOBILES

BASES

PORTABLES

PAGERS

REMOTES

MOTOROLA

ROA

BOARDS

STRIPS

ACCESSORIES

ELEMENTS

REEDS

Circle (131) on Fast Fact Card

Call

Joyce

Courier ProCom MU54

HANDHELD UHF FM TRANSCEIVERS
5 WATTS - FOUR CHANNELS

PROVIDES INSTANT COMMUNICATIONS
WITH KEY PERSONNEL INSIDE/OUTSIDE

*Ideal for use in factories, office buildings,
shopping malls, construction sites and for
security control.*

FEATURES INCLUDE:

- Lightweight, only 13 oz. miniature, sturdy high-impact plastic case, with belt clip and carry case.
- Rechargeable nickel cadmium battery pack, A.C. battery charger, flexible antenna with BNC connector, FCC license application included.
- Jacks for A.C. charger, earphone, external speaker/microphone, and external antenna with BNC connector.
- Adjustable squelch control/tone squelch on-off switch.
- FCC type accepted for Part 90 and 95
- Operates on General Mobile Radio Service and Business Band Radio Service.
- One set of crystals installed for channel 1.
- Crystals available for: GMRS, GMRS-SIMPLEX, REPEATER FREQUENCIES, BUSINESS BAND

FANON Courier

(800) 345-1354

14811 MYFORD ROAD • TUSTIN, CALIFORNIA 92680
(714) 669-9890 • FAX: (714) 669-1081

913-967-1923

to place your

classified ad

in the

very next

available

issue.

Circle (105) on Fast Fact Card

September 1993

RadioMate®

We don't just manufacture headsets...
We design and engineer
headsets to meet your requirements!

Headsets For Most All Radios and Telephones



HCS Telecommunications (800) 346-6442

Circle (134) on Fast Fact Card

• PAGER • PAGER • PAGER • PAGER • PAGER • PAGER •

McMANUS COMMUNICATIONS

501/763-6250
FAX: 501/763-6533

"Authorized Dealer of
NEC Paging Products"



Also —

- Refurbished Motorola, NEC, and Panasonic Pagers
- New Panasonic Pagers
- Pager Parts and Accessories
- Reeds, Filters, Code Plugs, etc.

We Repair Pagers — Used Pagers Wanted

We Provide Support for our Canadian Customers, Too!
"One call gets it all!"

• PAGER • PAGER • PAGER • PAGER • PAGER • PAGER •

Circle (106) on Fast Fact Card

LAND MOBILE RADIO BBS

Buy - Sell - Trade used radio equipment with hundreds of other dealers nationwide. Call with your modem to register now.

The CommLine BBS
313-854-6441

TONS

OF MOTOROLA USED EQUIPMENT!
Mitretek, Micor, Syntor, Maxar 80 & OTHERS
(For Sale!) ➔ **800-231-0103**

CLEAN USED GEAR

Cushman CE-4 & CE-6 Service Monitors
GE Phoenix SX VHF, 2/16 CH & Scan
GE MLS LB, VHF, UHF 2/8/16 CH & Scan
GE MASTR II & Exec II LB, VHF, UHF
GE MVP, VHF
GE MASTR II Base/Rptr LB, VHF, UHF
Motorola Mocom, Micor, Mitrek LB, VHF, UHF
Motorola Mox, Maxar, -50, -80 LB, VHF, UHF
Motorola Mostar 800T
Motorola Base/Rptr/Consolettes LB, VHF, UHF
Standard GX3000 VHF, UHF 64 CH Synth/Scan
Standard 966L LB, 75 Watt, Synth
Mostar VHF, Maxtrac 900MHz

NEW STANDARD RADIOS AT DISCOUNT! CALL NOW
Harris Alpha 2000E VHF IMTS
Motorola Pulsar VHF IMTS & Others
Motorola MT500 LB, VHF, UHF HT
Motorola MT/HT/ Gang Chargers
Standard HX300, 320, 734, 834 VHF, UHF HT
Standard HX400 VHF, UHF 25 CH Synth 5W HT
Uniden SPH & SPU 8 CH Synth HT
Wescor 2 GHz Microwave, MUX
Standard GX-1500U
GE Deskon II DC Remotes, Motorola Local Remotes
MORE - MORE - MORE - MORE - MORE - MORE

VersaTel

We Buy Used Equipment — CALL!
Ph: 1-800-456-5548
Fax: 1-307-266-3010

Circle (107) on Fast Fact Card

PAGER CRYSTALS

Precision crystals at affordable prices.
Common frequencies for popular pagers in stock.

•• SAME OR NEXT DAY SHIPPING ••
••• NO EXTRA CHARGE •••

CRYSTRONICS, INC.

We've got the crystals

Phone 305-566-6949 Fax 305-566-5971

QUALITY USED PAGERS LOW BAND VHF/UHF & 900Mhz

MOTOROLA
BRUNNEN
BRUNNEN

MOTOROLA
PANADATA 4000
BRUNNEN IDP 5000
IDP 7000
ENVOY
SPIRIT
BRUNNEN TONE
BRUNNEN ALPHANUMERIC

FOURTH DIMENSION INDUSTRY, INC. 36-427 1220
2ND DENTON COURT
BIRMINGHAM, NEW YORK 12010 FAX 516-427-1610

USED RADIOS at Low Prices!

- | | |
|-------------|-----------------|
| • MICOR | • GE |
| • MITREK | • RCA |
| • PORTABLES | • ACCESSORIES |
| • MOCOM 70 | • TONE ELEMENTS |
| • MAXAR | • CRYSTAL ELEM. |
| • RPTRS | • BASE STATIONS |

Large Quantities • (817) 433-5452

USED PAGERS

Motorola and NEC. Reconditioned on your channel w/warranty, or "as is".

ACS (303) 337-4811
FAX (303) 337-3084

For Sale Centra Com I —Whole or in Parts—



Centra Comm II
Engraved Buttons.
\$6.50 per button.
All orders shipped
within 48 hours.

Centra Comm II
Reprogramming and
Custom Changes

Northeastern Communications Inc.
Waterbury, CT 06708
(203) 575-9008

YOUR STOCKROOM HAS IT ...



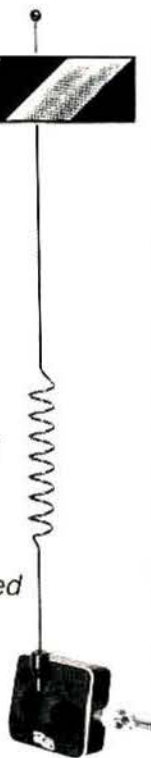
ON-GLASS®
Standard of
the industry!

Semi-flexible foot

One-step easy
mount

100% Factory-tuned

Limited Lifetime
Warranty



**THE
COMMUNICATIONS
EXPRESS**

US: 1-800-631-7297
FAX: 1-800-327-0007

Circle (108) on Fast Fact Card

Equipment for sale

- (1) Mocom 70 UHF\$250.00
- (4) Mocom 70 44 MHz\$125.00
- (1) MASTR II 30-36 MHz. N/A\$150.00
- (1) MASTR II 450 MHz, dual
front end, scan\$225.00
- (1) MASTR II, 450 MHz\$135.00
- (1) MICOR 44 MHz200.00
- (1) Ex. II, Base 450 MHz\$400.00
- (5) Phoenix-SX VHF\$185.00

(716) 385-4145



**STICKERS, LABELS,
NAMEPLATES**

ADVANCE LABEL & TAG
1725 N. McDONALD ST.
MCKINNEY, TEXAS 75069

1-800-466-5345 214-542-5345

We design and manufacture LABELS that
STICK and guarantee the QUALITY.

CALL FOR FREE SAMPLES

Outstanding quality at competitive prices.

Se Habla Español

MOTOROLA Radius DELIVERY NOW!

One of the largest stocks of Motorola Radius in the world.
Every Model in Stock! Free Programming of all new units on Delivery!
Will Positively Be Shipped Tonight!

On your jobsite tomorrow. We can handle any size order and have
done so for 20 years.

CALL 1-800-53-RADIO (72346)

FAX (706) 568-4506

To place your order, even if you live in Hawaii, Virgin Islands, Alaska or
Puerto Rico. **RADIO WHOLESALE - John Cunningham WB4-JUN.**

Circle (109) on Fast Fact Card

BUY—SELL—TRADE

- GE 900MHz Paging TX Call
- GE 900MHz SMR Repeaters Call
- Micor Base Repeater from \$1295
- Master II Base Reprtr from \$1295
- Mocom 70 Consoles from \$250
- Mocom 70 Mobiles from \$100
- Micor Mobiles from \$150
- Mitrek Mobiles from \$150
- Master II Mobiles from \$150
- EX II Mobiles from \$100
- Phoenix / MVP from \$150
- DC/Tone Remotes from \$100



Bob Barnett
Owner—WSRHL
FCC 1st Class Tech
30 Years in
Communications

Bases / Repeaters / Mobiles
No Used Pagers-Portables or Parts
Cash + Shipping Paid Promptly
Call for Quote or Sales List
Warehouse 1-501-835-7066
Fax 1-501-835-8766

BARNETT ELECTRONICS, INC.

8718 Wilhite Lane • North Little Rock, AR 72120

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE
NUMERIC
DISPLAY PAGERS
BPR 2000 DISPLAY
DIMENSION 2000 DISPLAY
D4N A & C STYLE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.

WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER
2000 Deane Court • Holbrook, New York 11741
516-677-1220 Ext. 227

RADIUS

★low-low-low★

MOSS COMMUNICATIONS INC.
1-800-822-6677

Towers and Land for Sale

Former Western Union Sites in 15 states.
Land, buildings and towers plus some
microwave equipment for sale. Prices
vary by location. For details call Agent
Joyce Castille.

800-852-8166 or 619-497-3458.

Obstruction Lighting That's Not Sky High

ElectroFlash™ Aviation Lighting Systems

- Medium and High Intensity Obstruction Strobe Lighting
- ETL Certified. FAA, Transport Canada and ICAO Approved
- Compatible with Dual Installations - Auto Restart
- Available with AC, DC, or AC/DC Combo Input Voltage
- Installation and Service Maintenance Available
- Equipment Warranted for 24 Months - Includes Flash Tube

P.O. Box 329, Nashua, NH 03060

Phone: (603) 883-6500

Fax: (603) 883-0205



Circle (110) on Fast Fact Card

Equipment for sale

LOOK!
WHOLESALE PRICES ON ALL MOTOROLA RADIUS
AND OTHER MOTOROLA PRODUCTS

RADIO CENTRAL, Inc.

1-800-923-6872

OR FAX YOUR RFQs TO (205) 476-4768

YOU'VE CALLED THE REST - NOW CALL THE BEST!
36 YEARS FACTORY EXPERIENCE

Circle (111) on Fast Fact Card

Introducing ... **NEW**
SC II
MINITOR II
SCAN OPTION

NEW option turns your MINITOR II®
into a SCANNING PAGER

- Lets you listen to the action on both frequency 1 and 2
- Lets you be alerted in the scan mode
- Easy to turn on and off
- NO MORE MISSED CALLS

COMPLETELY INSTALLED

Non Priority Scan **\$69.00** Priority Scan **\$89.00**

Only from **COM-TECH ELECTRONICS**

5 Krey Boulevard

Roseland, NY 12144

(800) 344-4896 • (518) 283-0958

DEALERS WANTED

• MINITOR II - a registered trademark of Motorola
Not recommended for warranted pagers.

CLEAN MOTOROLA RADIOS

MOBILES	
100W SYNTOR X VHF/UHF 16 F SCAN PROGRAMMED	\$1,395
100W SYNTOR 9000 VHF W/UHF PAC/RT	\$1,995
100W MARATRAK VHF & UHF A7 99F SCAN	\$995
100W MARATRAK VHF & UHF A3 8F SCAN	\$895
100W MITREK LOW BAND 39-50 MHz PL	\$395
100W MICOR UHF 12F WIDE SPACED PL	\$295
100W MICOR VHF 4F PL	\$295
25W MAXTRAC VHF & UHF 16F SCAN	\$350
45W MAXTRAC VHF & UHF 16F SCAN	\$425
30W SPECTRA 900 MHZ "A5"	\$595
PORTABLES	
5W P200 & HT600 6F VHF & UHF	\$550
4W MT1000 16F UHF 695 99F UHF	\$995
2W SABER 11 VHF DVP CAP NEW IN BOX	\$1,095
5W SABER 111 VHF & UHF W/RAPID CHARGER	\$1,495
CONVERTA-COM MT1000/HT600/MTX800/MX/STX	\$350
REPEATERS	
25W RP71PL UHF W/DUPLEXER	\$1,795
75W UHF MICOR COMMUNITY	\$2,995

RADIO EXPRESS, INC. - NORTHERN VIRGINIA
"AMERICA'S FAVORITE RADIO BUYING PLACE"

OFFICE 703-266-1928 FAX 703-830-0710

ORDERS ONLY 800-545-7748

"WE BUY USED MOTOROLA & RADIUS RADIOS"

MAJOR CREDIT CARDS ACCEPTED



CAL CRYSTAL LAB., INC.

CRYSTALS FOR ALL RADIOS

- ♦ Communication Crystals
- ♦ All makes and models
- ♦ Channel Elements
- ♦ Recrystallized and compensated

Competitive pricing!

Emergency Service

For Crystals 24 Hours • 72 Hours • 1 Week
Normal Delivery 3 Weeks

800-333-9825

FAX 714-491-9825

1142 N. Gilbert Anaheim, CA 92801

MOTOROLA RADIUS

Monthly Special: GP300s, VHF & UHF,
8 ch. with all access. \$477.00 and
\$507.00 respectively, while supply lasts.

FROM THE LEADER IN PROVIDING MO-
TOROLA RADIUS EQUIP. AS OUR OVER
2,000 CUSTOMERS KNOW, SHOP FIRST
THEN CALL PROCOMM FOR BEST
PRICE AND PROMPT COURTEOUS
SERVICE.

PROCOMM

Phone/Fax 805-497-2397

**YOU PAID
TOO MUCH!**



If you didn't
buy your Radius
from the factory
or from
California Radio

1-800-231-0103

We put a smile on your face! ☺

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

**ONE ONLY
PAGERS**

ENVOY

BRAVO TONE

D3 TONE

FOURTH DIMENSION INDUSTRY, INC.
WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER
3001 Dante Court, Hollisbrook, New York 11741
(516) 467-1220
Fax: 516-467-1220

**BUYING ERICSSON - GE EQUIPMENT
CALL OR FAX FOR QUOTE**

MASTER II STA. 100W 42-50 from	\$1,200
MPI UHF 4W W/CG & Charger	\$165
MPI Multi-Charger, 8 Unit	\$75
Delta-S 150-174 no. acc. 110W	\$275
Delta-S 450-470 40W S-990 acc.	\$299
Delta-S 450-470 40W no acc.	\$199
Delta-S Low band and "T" band	Call
VHF PLS Port. 16 ch w/GESTAR	\$199
PLS/MPD/MPA Multi-chgr. NEW	\$100
Phoenix-SX 406-430 16 ch. NEW	\$225
MASTR II 150-174 110W	from \$115
MASTR II 450-470 40W	\$165
MASTR II Accessories complete	\$50
C-500 two channel scan head	\$25
MASTR II cables	\$20
Reconditioned speaker & mic. ea.	\$10
New mic. with round metal plug	
works Pro., Exec I, II ect.	\$15
S-990 128 ch. head w/warranty	\$125
MPS/MPR/MPX/MPI/MPD Chargers	call

NEW LONDON TECHNOLOGY

231 Old Timberlake Road

Forest, Virginia 24551

TEL 804-525-0068 FAX 804-525-0078

Equipment for sale

Channel Elements

100,000 Freqs in Stock!
MASTR II, MVP, EXEC II
MICOR, MOCOM & MOTRAC

\$20 w/trade or \$25 w/o trade
Lifetime Warranty

3-Day Standard Delivery

1-800-237-9654

FAX: 513-542-8870

CHANNEL ELEMENT HQ.

4120 Kirby Road
Cincinnati, OH 45223

We Buy Channel Elements.

LOOK WHAT PRIMUS HAS IN STOCK FOR SAME DAY SHIPMENT TO YOU...

PolyPhaser

...TO KEEP YOU
COMMUNICATING

LIGHTNING/EMP and
GROUNDING SOLUTIONS...

primus

ELECTRONICS CORPORATION

800-435-1636 (IL) 800-892-1413 FAX 800-767-7605

Circle (112) on Fast Fact Card

Why Electro Dynamics Crystal? We go the extra mile!

LMR and Pager crystals for most models. For the best delivery, quality and price call: 1-800-332-9825.

1-800-EDC XTAL.

ELECTRO DYNAMICS CRYSTAL CORP.

9075 Cody

Overland Park, KS 66214

NOT JUST ANOTHER CRYSTAL CO.

Introducing...



Model 1012C
The next generation of
status reporting equipment from:



**Pyramid
Communications**

210 Main St. #153 Seal Beach CA 90740 Order Hotline: (414) 730-4190

Finally, a low cost reliable alternative to
Speedcall's™ 912C status reporter...

- Direct replacement for aging units or add ons.
- Status reporting, sel call, horn honk, interrogate, group call, console assign and ANI on PTT.
- Parameters are front panel programmable. Extensive self test and alignment capabilities.
- LTR™ and Motorola trunking compatible.
- Compact: Only 5 1/4" x 4 1/4" x 1 1/4"

Suggested Retail: **\$425⁰⁰**

Circle (113) on Fast Fact Card

ACTIVE FILTERS

AND

REEDS

FOR MOTOROLA PAGERS
FAST DELIVERY

Bramco.

PH (513) 773-6255

P.O. BOX 1482, PIQUA, OHIO 45356

IFR 1200S

like new w/ Tracking Gen Opt 12,
Battery, accessories, case, manuals
\$7,895 Gary 916.791.1665 or
Roger 916.966.7776

MSR 2000 150 MHZ

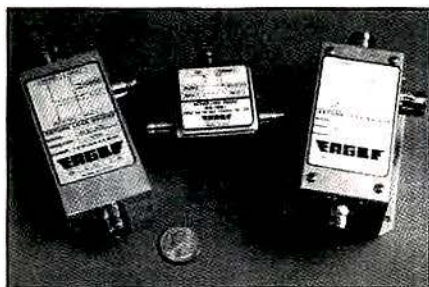
100 watt continuous duty repeater. Fully optional
model in 32 inch cabinet.

\$4500

Mitrek 100W 38-50 MHz 4ch PL \$295 ea.

Contact Ray Schall.

503-267-6064



Return Loss Bridges Features

- Directivity: >45 dB typical
- Internal reference and RF reflected port
- High power rating: 5 watts
- Swept SWR measurements
- Rugged construction
- .04 Mhz to 3.0 GHz

Return Loss Bridges are a low cost solution for swept SWR measurements. These bridges can be used with a spectrum analyzer/tracking generator or service monitor. Being a self contained unit, no external attenuators, amplifiers, comparators or detectors required. Easy to use: Connect generator to "source" port, analyzer input to "reflected" port. Set reference level with "load" port open, connect your device under test and take reading. Five watt power rating, unmatched in the industry, protects YOUR bridge from power coming down the feedline during antenna measurements at crowded sites. Rugged nickel plated brass enclosures assure excellent durability and shielding. Return loss bridges are useful for tuning antennas, receiver front ends, cavities, duplexers, isolators, and pre-amps; they also can be used for cable fault location, impedance and structural return loss measurements.

FREE application note, "High Performance VSWR Measurements", call and ask for it!

Application note discusses the relationship of VSWR, return loss and reflection coefficient in basic, simple to understand terms. It also discusses how to use the bridge and suggests possible applications.

Table of available models:

Model	Freq. MHz	Direct.	Price
RLB150B1	.040 to 150	45 dB	\$269.00
RLB150N3A	5 to 1000	35 dB	\$329.00
RLB150N3B	5 to 1000	45 dB	\$389.00
RLB150N3C	5 to 1300	45 dB	\$425.00
RLB150N5A	5 to 3000	40 dB	\$579.00
RFT050NM2	DC to 3000 load	40 dB	\$125.00

EAGLE

WICHITA

Phone: Voice: (316) 942-5100

FAX: (316) 942-5190

P.O. Box 9446 Wichita, KS 67277

Circle (114) on Fast Fact Card

NEW! Tone-Master™ Touch Tone Decoder



MoTron Electronics
310 Garfield St., Suite 4 Eugene OR 97402
Info: (503) 687-2118 Orders: (800) 338-9058
Fax: (503) 687-2492

Decode and display Touch Tones from a tape recorder, scanner, or nearly any audio source ✓ 16 digit LCD display, 80 digit scrollable buffer ✓ Built-in speaker ✓ 9V battery ✓ Metal case ✓ TM-16 PLUS includes RS-232 output and Software for optional date/time/ number logging using your IBM Compatible computer

TM-16 Standard Model \$169

TM-16 PLUS RS-232 Model with Software \$239

PS-12 AC Power Adaptor \$10

S/H \$5 USA/Canada, \$15 Foreign.

Visa, MasterCard & American Express Accepted

Classified

Equipment for sale

Sharp COMMUNICATION



Mobile Communications

- trunked & conventional
- mobiles
- portables
- accessories
- FREE programming

Official Distributor for:
RFI Connectors-Cables-Accessories
Telewave Site Management Equipment
Whelen Strobes & Safety Signals

Call for our current flyer!

WHOLESALE



Sheila



Paige



Order Today — Ship Today!

Circle (115) on Fast Fact Card

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR \$25 - \$35!!!

**ORDERS ONLY:
1-800-237-6519**

**INQUIRIES AND IN LA:
504-361-5525**

- ☐ Motrac; Micor, Mocom; Mitrek; Etc.
 - ☐ MT's, and GE Elements. Call for prices.
 - ☐ Any desired Frequency available for fast delivery.
 - ☐ Lifetime Warranty on Crystals
 - ☐ Trade-in credit on your Old Channel Elements
 - ☐ We Buy Used Elements
- Try us first. We always have your frequency available.

NKX

1814 Hancock St.
Gretna, LA 70053

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

**-tone / voice
PAGERS**

BPR 2000

SPIRIT

KEYNOTE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.
WORLD WIDE COMMUNICATIONS EQUIPMENT
3200 Duxbury Court, Holliston, New York 11741
Tel: 516-221-2297 Ext. 297

MOTOROLA & STANDARD TRUNKED RADIOS

MOBILES 800 MHZ TRUNKED

15W COVERAGE PLUS MOBILE W/LORAN RCVR	\$2,195
WIKEYBOARD	\$2,995
COVERAGE PLUS MAC COMPUTER W/SOFTWARE	\$2,995
15W TRAXAR	\$250
15W MOSTAR FROM	\$325
15W MAXTRAC B1 & B5	\$495
B6 & B7	\$545
35W MAXTRAC B1 & B5	\$545
35W B6 & B7	\$595
35W SYNTOR X MULTI SYS	\$395
SYNTOR 9000E	\$995
35W SYNTOR X 15 SYS/15 SUB/TALKAROUND "NEW"	\$995
35W SPECTRA B7 10 SYS/SCAN/TALKAROUND	\$995
25W PP1000	\$695
PP1000X	\$995
25W GX30301 7 SYSTEMS SCAN CONV/TALKAROUND,	
WORKS ON MOTOROLA OR ET JOHNSON-LTR	
SYSTEMS. UNIT PROGRAMMED ONTO YOUR SYSTEM AT	
NO CHARGE. NEW IN BOX. 3 YEAR WARRANTY	\$895

PORTABLES 800 MHZ TRUNKED

2W MTX800 W/CHGR	\$595	MTX800 6 SYS/3 SUB	\$650
2W MTX810 6 SYS/3 SUB/CONVENTIONAL	\$895		
3W STX 15 SYS/15 SUB DTMF SUPER CONDITION	\$1,095		
3W STX SMARTNET 1/11/111 GEMINI "AS NEW"	\$1,495		
2W HX5801 10 SYSTEMS. SCAN, CONV/TALKAROUND,			
WORKS ON MOTOROLA & JOHNSON-LTR SYSTEMS			
PROGRAMMED ONTO YOUR SYSTEM AT NO CHARGE.			
3 YEAR WARRANTY	\$895		

MOBILES 900 MHZ TRUNKED

12W B2 MAXTRAC	\$545	B5-B7	\$95
30W B7 MAX	\$695	12W B2 SPECTRA	\$595
12W B5 SPECTRA 10 SYS	\$695		
30W B5/B7 SPECTRA 10 SYS/SCAN/TEL	\$995		
30W L37VLB BASE	\$995		

PORTABLES 900 MHZ TRUNKED

2W MTX900 B3 & B4 6 SYS/3 SUB/CONV	\$650
------------------------------------	-------

RADIO EXPRESS, INC.
"AMERICA'S FAVORITE RADIO BUYING PLACE"
INQUIRIES 703-266-1928 FAX 703-830-8710
ORDERS ONLY 800-545-7748
"WE BUY MOTOROLA RADIOS"
MAJOR CREDIT CARDS ACCEPTED

Circle (130) on Fast Fact Card

UAntenna

Low Profile • Low Band
Antenna for Radio
Communication

Model CR109A
THE ULTIMATE LOW BAND

FEATURES:

- Up to 95% Height reduction
- Easy Installation
- High Performance • Low Cost

COM-RAD INDUSTRIES
PO Box 554, Grand Island, NY 14072
For Immediate Fax Info & Technical Assistance,
Telephone: 716/773-1445

40 YEARS OF QUALITY SERVICE

CRYSTALS-ELEMENTS

PHONE 800-725-1426 FAX 800-322-9426
INTERNATIONAL CRYSTAL MANUFACTURING, CO., INC.
P.O. BOX 26330 • OKLAHOMA CITY 73126

RAMSEY COM-3

The communications service monitor that's missing one feature . . . HIGH PRICE !

- Frequency coverage 100 KHz to 999.999 MHz
- Signal Generator 0.1 uV to 10,000 uV with reverse power protection . . . no more front-end blowouts!
- Built-in 1 GHz and audio frequency counter
- Modulation includes 1 KHz, CTCSS or external
- The most popular low cost high performance monitor. . . thousands sold worldwide
- Extremely portable, only 13 pounds includes rechargeable battery at no extra cost
- Call for free 10 day trial in your shop

\$2995.00

Ramsey Electronics Inc.
793 Canning Pkwy Victor, NY 14564
716-924-4560
716-924-4555 (FAX)

Circle (116) on Fast Fact Card

Now, here's a switch!

CHARGE GUARD

automatic ON/OFF timer switch for two-way radios, cellular phones

EASY TO INSTALL.
NO IGNITION SWITCH CONNECTION!

PROGRAMMABLE.
15 MINUTES TO 15 HOURS!!

Prevents Dead Batteries.

MADE IN U.S.A.
PROTECTS YOUR RADIO.
SUGGESTED LIST ONLY \$74.95 MODEL CG-1274
12 AND 24 volt MODELS AVAILABLE

CALL NOW FOR MORE INFORMATION!
ASK ABOUT OUR NEW DEALER KIT!

CHARGE GUARD
400 Highland Avenue
Altoona, PA 16602
800-458-3410

Circle (132) on Fast Fact Card

Equipment for sale

MIDLAND LMR
LAND MOBILE RADIO

STOCKING DEALER

SAME DAY SHIPPING

FULL PRODUCT SUPPORT

WHOLESALE TO DEALERS ONLY

MAJOR CREDIT CARDS ACCEPTED

LARGE INVENTORY OF MOBILES & PORTABLES

B & C Communications, Inc.

1-800-343-3004 - 201-670-1985 - (Fax) 201-670-7627

Circle (117) on Fast Fact Card

WE'RE NUMBER ONE (NUMERO UNO)

- #1 IN LOWEST PRICES FOR TOP QUALITY RADIOS
- #1 IN DELIVERY • #1 IN TOTAL RADIOS SOLD IN USA

CHECK US OUT!!!

RADIOS (MOTOROLA)

SP10 1W VHF	FROM \$188	P-50 2W VHF	FROM \$249
P-50 2W VHF	FROM \$259	P-110 2W VHF	FROM \$279
P-110 2W VHF	FROM \$349	P-110 4W VHF	FROM \$380
P-110 5W VHF	FROM \$395	P-110 4W UHF	FROM \$425
GP300 5W VHF	FROM \$480	GP300 4W UHF	FROM \$515
M100 25W VHF	FROM \$320	M100 25W UHF	FROM \$379
M100 45W VHF	FROM \$385	M100 40W UHF	FROM \$444
GM300 25W VHF	FROM \$385	GM300 25W UHF	FROM \$425
GM300 45W VHF	FROM \$415	GM300 40W UHF	FROM \$465

MONOGRAM (ERICSSON/GE)

MGP145 5W VHF/UHF 10F PORTABLE 2YR WARRANTY	\$415
MGM145 40W VHF 16F SCAN MOBILE 2YR WARRANTY	\$394
MGM450 40W UHF 16F SCAN MOBILE 2YR WARRANTY	\$436

STANDARD

HX241 5W 16F SCAN PORTABLE VHF/UHF 3YR WAR.	\$495
HX440 5W 200F SCAN ALPHA-NUM VHF/UHF 3YR WAR	\$795
GX2000 35W 36F SCAN VHF/UHF MOBILE 3YR WAR	\$595
GX3200 55W 200F SCAN ALPHA-NUM MOBILE 3YR WAR	\$725

RADIO EXPRESS, INC. - NORTHERN VIRGINIA
"AMERICA'S FAVORITE RADIO BUYING PLACE"

INQUIRIES 703-266-1928 FAX 703-830-8710

ORDERS ONLY 800-545-7748
CREDIT CARDS ACCEPTED

WE BUY AND SELL USED MOTOROLA AND GE FM TWO-WAY RADIOS

SCHAEFER RADIO CO.
1301 Grant St.
Box 395
Denver, IA 50622
(319) 984-6115
FAX: (319) 984-6220

9 MX340 800MHz Conventional H35AAU6110
25 Syntex 800MHz Trk. & Com. T45VBJS611
20 Syntex 800MHz Trk. & Com. T45XAJS611
25 Mostar 800MHz Trunked, D35TLA5G00
71 GE Carona 800MHz Trunked, 30 watts
20 GE Marc V Portables, 800MHz Trunked
26 Micor, 495MHz, T74RTA3000
44 Syntex 495MHz T545RA3200
2 MT500 495MHz H348BU3144
9 Micor Bases, 482MHz, 884RCB110SATSP2
12 Motrac Rptrs, 460MHz, C24MSY3101T
50 Syntex 460MHz, T645RA3200
20 Micor, 460MHz, T74RTA3000
9 Mostar, 460MHz, D44TZA7000
10 Mitrex, 460MHz, T44JA3000
5 Maxar 80 460MHz D34TSA3000
140 MX340 460MHz H444AU3140
165 MX Convertacoms, N1244
38 MT500, 460MHz, H348BU3124
1 Micor Rptr, 406MHz, C64RXB3106AT (w/DVP)
16 Syntex, 173MHz, T33XTA1200 (with DVP)
71 Micor, 173MHz, T53RTN3100
9 Maxar 80, 173MHz, D34TSA3000
1 MSR 2000 Base, 155MHz, C73GRB3106
8 Micor Bases, 155MHz, C73RTB1100
29 Syntex, 155MHz, T83SRA3200
2 Mitrex, 155MHz, T83JA3000
99 Micor, 153MHz, T73RTN3100
36 Mitrex, 153MHz, T83JA3000
4 Moxey, 153MHz, D43GMA4000
8 MT500, 155MHz, H33BBB3144
65 Minicor I Pagers w/Charger Amplifiers, 154MHz
2 Micor Bases, 72MHz, D42RCB3105
1 Micor Parc Base, 43MHz, B91JZB1101B
1 Micor Base, 43MHz, C71RTB3406
8 Micor Bases, 47MHz, C71RTB3406
1 Micor Base, 45MHz, B91LPB3406
1 Mitrex, 47MHz, T81JJA3900
8 Mitrex, 48MHz, T51JJA4900
7 Micor 70, 48MHz, T71BBA1000
14 Maxar 80, 47MHz, D51TSA4000
5 GE Master II, 48MHz, MCT4CC533
1 Motrac Base, 39MHz, B91LPB3406
1 Micor Base, 37MHz, C71RTB3406
8 Moxey, 31MHz, D31GMA4000
20DC Remote Desk Sets, T1376
5 Local Desk Sets, T1376
8 Standard, 48MHz, C966L

Hy-Q
International (USA)

- ☐ **PAGER CRYSTALS**
- ☐ **COMMUNICATION CRYSTALS**
- ☐ **CHANNEL ELEMENTS**
 - Recrystallized
 - Complete Elements

48-HOUR SERVICE AVAILABLE

(606) 283-5000

FAX: 1-606-283-0883

1438 Cox Ave., Erlanger, KY 41018
(Greater Cincinnati Area)

"Precision Quality Quartz Crystals—
Made to Your Specifications"

Circle (118) on Fast Fact Card

USED Radios Radios WANTED!
California Radio
800-231-0103

Equipment wanted

Equipment Wanted

Motorola, Johnson, GE,
EFJ, Uniden, Standard

Buy-Comm-Co.

1-800-347-4121

FAX (602) 585-6900

WANT TO BUY

Pagers: DBR 2000, NEC,
Mot. Bravo and Panasonic

Two Way Radios: 800MHz, UHF & VHF

Telepage Communications

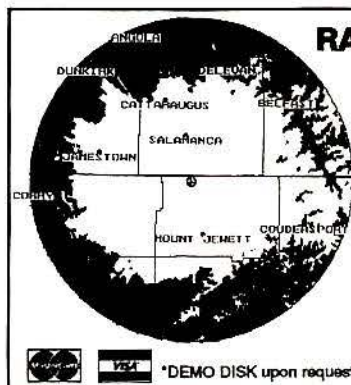
803-269-9699

WANT TO PURCHASE

Harris-Farion Channel Unit-UDL
634, 12 ch. or 24 ch. assembly for
LRI-2 system. Call Nick Powell.

904-239-5926

Computer software



RADIO ENGINEERING PRODUCTS

SOFTWARE

- 3-D Terrain Coverage Predictions
- Fresnel Zone Studies
- Engineering Package
- Intermodulation Studies
- 3 or 30 Second Terrain Files

FCC INFORMATION

- Dial Access
- State Frequency Lists
- Custom Searches
- Mailing Labels
- Print-outs
- Data Files



C.E.T., INC.

1001 S. Ridgewood Ave.
Edgewater, FL 32132

Phone: 904-426-0014 • Fax: 904-426-0099

Circle (119) on Fast Fact Card

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo-Graph (Profiles)
- HAAT Calculations

Computer software

SMR BILLING / ACCOUNTS RECEIVABLE \$396

*CES *IDA *Johnson *Trident *Uniden *Zetron

Billing

Recurring Billings (flat rate)
Daily Billings
Air Time Billing
Long Distance Billing

Accounts Receivable

Apply Payments
Generate Statements
Print AR Ageings
Generate Service Charges

- Handles all of your business billings.
- Easy to understand and learn.
- Requires a minimum of file data keying.
- Mix or match different download formats.
- Simple and flexible approach to sales taxes.
- General Ledger Interface.

CLEVER SOFTWARE

3033 13th Ave. SW, Suite #139
Fargo, ND 58103

Phone: 701-237-0095 Fax: 701-237-0228

Ask about
our monthly
billing
service

Advanced RF Coverage and Propagation Software

Applied Spectrum Research

- * Radio Area Coverage
- * Path Profiles
- * Land Use/Vegetation
- * Easy to Use on Your PC
- * Full Range of Design Options
- * Single or Multi Site/Cellular
- * Digital Topography
- * Geographic Boundaries
- * International Applications

2975 Valmont # 100
Boulder, CO 80301 USA

(01) 303 444 4871
FAX: 303 444 4872

Pyramid Communications Service Management Software

Version 3.0
Only \$279



Inventory
Radios

Serial #'s
Shop Eq Par
Shop History

Mailing labels
Kits

Invoices
Productivity Reports

Customer Data
Repairs

Free Demo
& Manual

210 Main St #153 Seal Beach CA 90740 (414) 730-4190

Software For

401 **FCC Licensing** ch-B
189 **and**
102 **Price Quotes** 194
574

SLATTERY SOFTWARE
(619) 560-0644

The Service Processor Computerized Work Ticket, Automatic Inventory adjust, Auto Ticket Pricing, On line service history MA or T&M, MA records, Frequencies Cap Codes Etc. On line Help. Generate any Report. Easy to use. Character oriented, or mouse driven. Network and Windows ready.
DEMO, ACTUAL SOFTWARE, FREE
Midwest Data Service
P.O. Box 178, Philo, IL 61864
217-684-2641

**RFCAD™
IS
HERE!**

The highest quality multi site coverage prediction software available for the PC. RFCAD™ uses both 3 Sec. Terrain Data and Land Use/Land Cover databases. Modules compatible with competing software packages. Runs under Microsoft Windows. Fully operable run-time demo available. Affordable combinations of modules and geographically limited data packages are available.

Richard P. & Richard L. Biby, Principals



**Communications
Data Services, Inc.**

6105-F Arlington Blvd.
Falls Church, VA 22044
(703) 534-0034
(800) 411-0034

Circle (120) on Fast Fact Card

Identify and prevent RF communications site interference in minutes rather than hours.

Powerful PC software that picks up where all other Intermodulation programs leaves off.

- Transmitter Noise/Receiver Desense Analysis
- Intermodulation Signal Level Analysis
- Eliminates Manual look-up of filter curves

COMSITE™ PLUS

For a brochure, call 1-800-845-0408

**Terrain Analysis Package (TAP)™
PC-based software for RF studies**



SoftWright
Limited Liability Co.

1010 South Joliet, Suite 204
Aurora, Colorado 80012
(303) 344-5486
FAX (303) 344-2811
Tele TAP BBS (303) 344-5378

- Area field strength coverage maps.
- Shadow maps.
- Choice of propagation models.
- Point-to-point/microwave fade margin and reliability calculations.
- User-customized data base for buildings and vegetation.
- Digital elevation data on floppy disk or CD-ROM.
- Intermodulation product studies.

Free demo disk upon request.

Circle (121) on Fast Fact Card

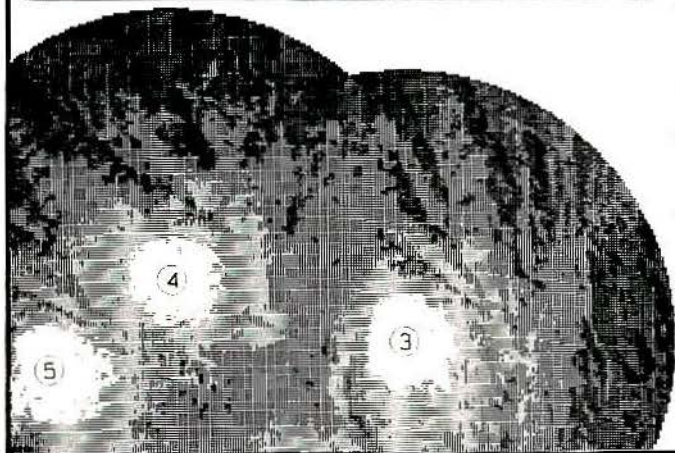
Computer Resources Inc.

The Service Management system is designed for the management of a mobile communications company. It provides the user with work orders, and work order history, inventory control and purchasing, contract management and costing, equipment management and costing, and technician productivity. Also available are Recurring Billing, SMR Billing, Pager Billing and Inventory, plus Accounts Receivable, Accounts Payable, General Ledger, and Payroll.

205/987-1523

Circle (133) on Fast Fact Card

MULTI-SITE COVERAGE



MSITE™, our latest terrain-based propagation program, offers you multi-site composite analysis of field strength, received power, C/I ratio, most likely server, and basic shadowing for up to 50 transmitter sites. It's another example of EDX's leadership in communications engineering software tools.

■ Propagation software - whether it's **MSITE**, or our newest product **MCS™** for microcell ray-tracing simulations, or our industry standard **SHDMAP™** and **RPATH™** programs, for 8 years EDX has been the innovator in PC propagation software.

■ Terrain data - EDX was the first (and only) company to offer the entire US 3" terrain database on a single CD-ROM.

■ International presence - EDX has customers in more than 30 countries on 6 continents. From the borough of Manhattan to the Great Barrier Reef, the sun never sets on EDX software.

Send for our complete software catalog today.

EDX Engineering, Inc.

P.O. Box 1547, Eugene, Oregon U.S.A.

Tel: (503) 345-0019 Fax: (503) 345-8145

Circle (122) on Fast Fact Card

The SENTRY "Service Manager"

The technicians very own encyclopedia of service department information. A collection of over 50 Programs, Charts, Formulas and Conversion Factors. Information required daily, now on your service shop computer.

Faster than looking it up in a book..

Send \$ 79.95 Check or Money Order to:

SENTRY USA®

P.O. Box 372416

Indian Harbour Beach, FL 32937-0416

Telephone (407) 773-6090 FAX (407) 773-6092

Circle (123) on Fast Fact Card

Tower space

BADGER MOUNTAIN

SE Washington - Benton County

SITES AVAILABLE

N.L. 46° 14' 46" W.L. 119° 19' 31"

EL 1579 MSL

Badger Mountain Antennae, Inc.

(509) 582-3437

John M. Rowe
Communications Real Estate
Site Acquisition, Site Marketing &
Zoning Specialist
1236 Corona #2
Denver, CO 80218
(303) 830-0815



REALTOR*

TEL: (708) 823-7713
**CHICAGO TOWER
LEASING GROUP**
COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA
P.O. Box 31160
CHICAGO, IL 60631



STAN STANN

Mt. Vaca Radio Site views Northern
SF Bay Area and Sacramento Valley solid.
Single space, entire building rental or lease.
Power, telco, 150ft. tower, 24hr access.
Please call or write: Radio Properties, PO
Box 192, Elmira, Calif. 95625,
phone (707) 446-3419

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS (CEMS)

RADIO COVERAGE ENGINEERING SOFTWARE (RCES)

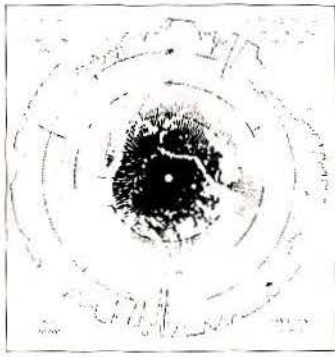
3 Second
Terrain Data

MICROWAVE

- Menu Driven - Color Coded
- On-Screen Path Profile Design
- Diffraction Loss Calculations
- Reflected Signal Analysis
- Route and System Diagrams
- Map Crossings - Graphic with Dimensions
- Performance Predictions: Analog, Digital and Video

LAND MOBILE RADIO

- Coverage Diagrams
- Multiple Prediction Models
- 360 Radials - 50 Mtr (50 Km) Radius
- Relief Maps in Color
- Intermodulation Calculations
- 300 Tx and Rx Frequencies
- Up to 99th Order
- Graphic Presentations



NORTON ENGINEERING
10002 McDuff Court
Vienna, VA 22181
703) 938-5745
Fax: (703) 938-9168

Demo Disk
and
Sample Printouts
Available

Circle (124) on Fast Fact Card

Classified

Tower space

We've got you covered.

For superior antenna site coverage along with the Quality and Customer Service you expect from an industry leader - choose Motorola. Our nationwide network of antenna sites offers you space on thousands of premier antenna sites across the country. Contact Motorola Network Services Division today for your local and national site needs or to find out more about our site planning and management services.

U.S. Network Services Division,
Antenna Site Information
708-576-5484



© Motorola, 1991. ® and Motorola are trademarks of Motorola, Inc.

Circle (125) on Fast Fact Card

Free!

Here's the first step designed to save you time and money!

Whether you're a communications newcomer or an experienced pro, you'll find this handy booklet invaluable for:

- ✓Paging
- ✓Satellite
- ✓Dispatch
- ✓Microwave
- ✓Cellular
- ✓Telemetry
- ✓Broadcast
- ✓Data
- ✓Personal or Business
- ✓Specialized Mobile

When you need help in selecting a communications site, call the northern California experts. With 33 well-managed sites in key locations and a personable, dedicated staff, we'll get you up and on-the-air fast.



DIABLO COMMUNICATIONS, INC.

1220 Brickyard Cove Road, Point Richmond, CA 94801
(510) 236-3700, Fax (510) 236-3799 Ask for Mr. Pringle

Circle (126) on Fast Fact Card

37 CALIFORNIA ANTENNA SITES

- Major Locations • Stand-by power
- Secure facilities • Air Conditioning



Or develop your own site.
Land available at
Oat Mountain/Chatsworth.

MERIDIAN COMMUNICATIONS

Since 1956

23501 Park Sorrento, Ste. 213A
Colobos, CA 91302-1355
Contact Rich or Jack Reichler at
818/888-7000

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi

ANTENNA SITES, INC.
602-451-7702

NEED TENANTS??

Advertise your sites in the

NATIONAL COMMUNICATIONS SITE DIRECTORY

Dedicated to advertising antenna sites for lease

NEED SITES?

The NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRAFAAM, Dept. M, P.O. Box 6093
Freehold, NJ 07728 (908) 462-5964

PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AMSL, 2635' AAT, Emergency Power, Air Conditioning, Overlooking Reno, Fallon and the I-80 corridor,

702-825-2626

GREAT BASIN COMMUNICATIONS

TOWER SPACE

Westchester • Putnam • Rockland Connecticut

Combiners 70-960MHz Bogner and Antel antennas 450-960MHz with downtilt and null fill. Satellite earth station antenna available. Emergency generator, A/C. Elev. over 1,000 ft. Easy access all year. Covers Westchester, Putnam, Rockland and parts of Conn. Contact Jerry Agliata.

SIGNAL TOWER COMPANY, INC.
914-633-0569 • Fax 914-633-9315

WESTERN WASHINGTON

Commercial power with generator backup. Good security. Year around access. Four Sites.

GOLDSPAR COMMUNICATIONS
Alan Robinson

206-475-9430 Fax 206-475-9410

Tower space

COMMUNICATIONS SITE SPECIALISTS.

- Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing.
- Sites Available Now... CA, DC, FL, IL, IN, LA, MA, MD, MI, MO, NC, NJ, OH, PA, TX, & VA



FACILITIES MANAGEMENT

2400 Ownby Lane, Richmond, VA 23220
(804) 353-4782 • Toll-Free (800) 438-3810
FAX: (804) 353-8059

10 Woodbridge Center Drive, Woodbridge, NJ 07095
FAX: (908) 536-7260 • Toll-Free (800) 247-4795

Repair services

LOUDOUN COMMUNICATIONS, INC.

Communications Systems
REPAIR DEPOT

Microprocessor based Mobiles,
portables, controlheads.
GE Warranty Processing
Fast turn-around



585 Factory Shoals Road
Austell, GA 30001

404/948-9566



**Triton
Electronics, Inc.**

SERVICE MONITOR REPAIR & CALIBRATION

Exclusive monitor repair since 1973

NIST TRACEABLE

Cushman, IFR, Motorola, Marconi

4300 Lincoln Ave., Unit O
Rolling Meadows, IL 60008
(708) 934-6426 Fax (708) 934-7195



RF Fuse Protector for IFR Service Monitors

- Fits models 500(A), 1200A/S and 1500
- Just \$90, postpaid, inc. 2 spare fuses
- Costs less than your first repair job!

**COMMUNICATION
INSTRUMENTS**

Phone (800) 288-8223
356 Hillcrest Street
El Segundo, CA 90245

\$25.00 FLAT RATE

Plus Parts & Shipping
On the following models:

XLH-250 RH-250
RH-256 WH-256
WH-2510 RFH-252
UC-102 UC-202
TRH-202



REGENCY/WILSON

*OTHER MODELS—\$25/HR Plus Parts & Shipping

MULTICOM

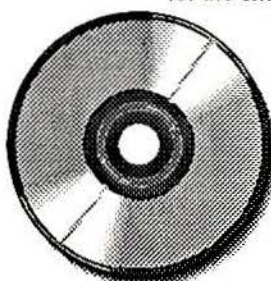
2608 N. Moore Ave.
Moore, OK 73160-3316
405-799-7356 800-880-7356

- FAST TURNAROUND
- FACTORY TRAINED
- VISA • MASTERCARD • COD

CDROM

FCC MASTER FREQUENCY DATABASE CDROM

All frequencies within the FCC Master Frequency Database
for the entire US on CDROM



Dbase File Structure (ASCII Avail)

Exporting Available

Frequency, Callsign, DBA Name,
Licensee, City, State, Zip

Transmitter Lat & Long,
Elevation, Antenna Height
Address and County

Radio Service Code, Issue &
Expiration Dates and more

Custom Databases Available

Full Master Frequency Database Available on CDROM
Single Subset/US \$99.95 Single State/All Subsets \$149.95
Call for more information about our complete product line.

PerCon Corporation
CD Applications Division
4906 Maple Springs / Ellery Road
Bemus Point, NY 14712

(716) 386-6015 (716) 386-6013 FAX



Circle (127) on Fast Fact Card

Repair services

NS ELECTRONICS SERVICE INC.

COMMUNICATIONS MONITORS SALES & SERVICE
N.I.S.T. TRACEABLE CALIBRATION
CUSHMAN IFR

SALES NEW-USED

3610 Dekalb Technology Parkway
Suite 110/111

Atlanta, Georgia 30340

(404) 451-3264

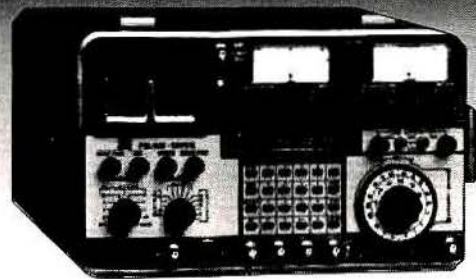
Fax: (404) 458-8785

CALL

AUTHORIZED
CUSHMAN SERVICE

SERVICE MONITOR REPAIR/CALIBRATION

Specializing in Service Monitors since 1973



**We buy and sell
used monitors!**

Phone (800) 288-8223
or (310) 322-3666



**COMMUNICATION
INSTRUMENTS**

356 Hillcrest Street, El Segundo, CA 90245

Circle (128) on Fast Fact Card

Classified

Repair services

CALL

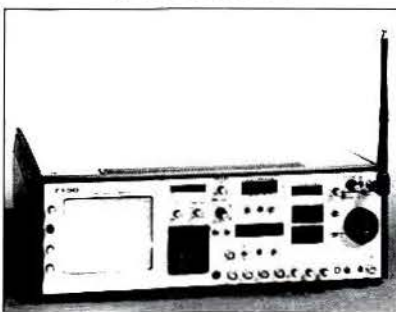
SALES & SERVICE
FOR NEW MODEL DEMOS

KNS ELECTRONICS, INC.
2146 BERING DRIVE
SAN JOSE, CA 95131

PHONE: 408-432-8100
FAX: 408-432-8359

MODEL 7130
TRACKING GENERATOR
OFFSET GENERATOR
1 GHZ GEN & REC
SPECTRUM MONITOR
ENCODER

CUSHMAN



Circle (129) on Fast Fact Card

BENDIX / KING

Authorized Service Center
Repair Services for all your
communications needs!

- FREE Estimates
- 90-Day Warranty
- Quick Turn-around
- FM / AM / SSB / CW
- Northwest Location

SKYLINE RADIO (503) 663-5858

ACS

"The Pager Repair People"

High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola, NEC, Panasonic and Shinwa.

(303) 337-4811 FAX (303) 337-3084

A d index/hot line

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
Advanced Receiver Research	64	55	203-582-9409	Mechem Electronics	99	101	703-373-3888
Air Comm	100	103	602-275-4505	Meridian Comms/Diablo Comms	71	63	818-888-7000
The Antenna Farm	99	100	800-255-6222	Meridian Comms-Comms Express	103	108	800-631-7297
The Antenna Specialists Co.	IFC	1	216-349-8400	Microwave Filter Company Inc.	48	41	315-437-3953
Astron Corp.	41	35	714-458-7277	Midian Electronics Inc.	55	45	602-884-7981
Automation & Electronics Eng.	99	102	800-527-4596	Modular Communication Systems	16	25	818-764-1333
Avtec Inc.	56	46	803-892-2181	Monark International Corp.	70	62	816-891-0700
BatteryPRO Centres Inc.	66	57	800-661-9401	Motorola C & E	85	82	708-576-5484
B&C Communications Inc.	107	117	800-343-3004	Motorola Government	17	15	800-235-9590
BEE Electronics Inc.	72	65	708-345-0337	Motorola Land Mobile Products	33,35	28,30	708-576-2034
Bomar	74	67	800-526-3935	Motorola Land Mobile Products	37,39	31,33	708-576-2034
California Radio	98		800-231-0103	MX-Com Inc.	7	7	919-744-5050
Cartwright Communications	27	22	513-489-1755	New Mar	82	78	800-854-3906
CELWAVE	20-21	17	800-321-4700	Norcomm Corp.	40	34	916-477-8400
Centurion International Inc.	9	8	800-228-4563	Norton Engineering	109	124	703-938-5745
CES Inc.	15	13	407-679-9440	Orbacom Systems Inc.	65	56	609-829-4455
C.E.T., Inc.	90,107	87,119	904-426-0014	Pekaar Communication Inc.	101	131	201-772-0704
Cimarron Technologies	25	20	800-487-7184	Polaris Industries	98	98	800-752-3571
David Clark Co., Inc.	43	37	508-751-5800	Polyphaser Corp.	73	66	800-325-7170
Combined Technologies Inc.	82	77	513-595-5900	Primus Electronics Corp.	105	112	800-435-1636
Communications Specialists	BC	3	800-854-0547	Pyramid Communications	105	113	414-730-4190
Communications Data Services	108	120	800-441-0034	Radio Central, Inc.	104	111	205-476-9484
Communications Associates	34,101	29,104	800-435-9313	Radio Express, Inc.	106	130	703-266-1928
Connect Systems Inc.	13	11	800-545-1349	Radiomate	102	134	800-346-6442
Control Signal Corp.	30	14	303-989-8000	Radio Wholesale	103	109	800-53R-AD10
CPI Communications Inc.	42	36	800-869-9128	Ramsey Electronics	106	116	716-924-4560
Cushcraft/Signals Corp.	19	16	800-258-3860	RELM Communications	75	69	317-545-4281
Daniels Electronics	46	39	604-382-8268	Ritron Inc.	89	85	800-USA-1USA
Datcom Inc.	84	81	217-222-0160	RCW Distributing	84	92	800-726-9015
Decibel Products, Inc.	29	24	214-631-0310	Santa Fe Distributing	80	74	913-492-8288
D & L Communications Inc.	72	64	219-484-0466	Scala Electronic Corp.	81	76	503-779-6500
Doppler Systems, Inc.	91	89	602-488-9755	Schlumberger Technologies	47	40	800-225-5765
Dynatech Tactical Comms	28	23	603-800-4411	Selectone Corporation	3	5	800-227-0376
Eagle Wichita	105	114	318-942-5100	Sentry USA	109	123	407-773-6090
EDX Engineering Inc.	109	122	503-345-0019	Setcom Corp.	66	58	415-965-8020
Fanon Courier	101	105	800-345-1354	Sharp Communication	106	115	800-548-2484
Flash Technology Corp. of AM	103	110	615-377-0600	Shinwa Communications of America	14	12	800-627-4722
General Communications	77	71	800-356-3200	Siemens Solar Industries	76	70	805-338-6341
Doug Hall Electronics	60	51	614-261-8871	Sinclair Radio Laboratories	49	42	800-288-2763
Henry Radio	60	50	800-877-7979	Softwright	108	121	303-344-5486
Hewlett Packard	32	27	509-921-4001	Solar Electric Specialties	86	83	707-459-9496
Hustler Inc.	61	52	800-949-9490	Sonic Communications Inc.	84	80	800-688-1944
Hutton Communications	38	32	800-442-3811	Tait Electronics USA Inc.	24	19	713-984-8684
Hy-Q International	107	118	606-283-5000	Telepoint Inc.	93	91	310-652-3666
ICOM America	45	38	206-454-8155	Telewave Inc.	62	53	415-968-4400
IFR Systems, Inc.	31	26	316-522-4981	Telex Communications, Inc.	78	72	800-554-0716
JBRO Batteries Inc.	63	54	800-323-3779	Transcrypt International Ltd.	5		800-228-0226
Kenwood U.S.A. Corporation	59	49	310-639-4200	Trylon Manufacturing Co. Ltd.	74	68	519-669-5421
Larsen Electronics	94	92	800-426-1656	TX RX Systems Inc.	26	21	716-549-4700
L & R Communications Ltd.	94	92	800-426-1656	Uniden Corp. of AM-MSG Inc.	11	9	817-858-3300
Marconi Instruments	57	47	800-233-2955	Unipage	51	43	800-367-2864
Marketronics Corp.	12	10	800-845-1230	VCP International Inc.	90,91	86,88	800-527-9366
Maxon America Inc.	69	61	816-891-6320	Vega, A Mark IV Company	1	4	818-442-0782
Maxrad, Inc.	23	18	800-323-9122	Versatel Comms	102	107	800-456-5548
McManus Communications	102	106	501-763-6250	Vertex/Yaesu USA	IBC		310-404-2700

The Vertex Line. Complete and Competitive.

6 Channel Economy Portable

Transceivers
FTH-2009 VHF, 134-174 MHz
FTH-7009 UHF, 450-470 MHz
Shown with optional FTT-6
DTMF Keypad.

15 Channel Compact Portable

Transceivers
FTH-2008 VHF, 150-174 MHz
FTH-7008 UHF, 405-470 MHz



**32 Channel
Heavy Duty Portable
Transceivers**
VX-500 VHF, 134-174 MHz,
5 Watt; VX-500 UHF, (TBA)
Shown with optional FTT-7
DTMF Keypad.

**32 Channel
Commercial Dual Band
VHF/UHF**
Portable Two-Way Radios
FTH-2070 VHF, 150-174 MHz;
UHF, 409-490 MHz*
*with degradation.

FMA-2070
Mobile Adapter (Not shown.)

When communication is critical – switch to Vertex! For business, industry and public safety, Vertex VHF/UHF compact portables, complete 4, 12/24 and 99 channel mobiles and exclusive FTH-2070 Dual Band portable with MIL-STD-810 C/D and FCC Part 80 are designed for years of tough field service and priced to suit any budget.



99 Channel
Synthesized Wideband Mobile Radios



12/24 Channel
Synthesized Wideband Mobile Radios



4 Channel
Synthesized Wideband Mobile Radios

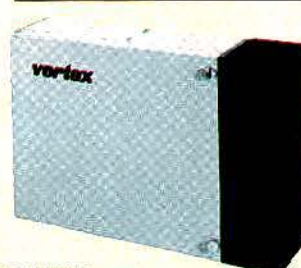
Frequencies

FTL-1011 Lowband:
37-48 MHz, 60 Watt
FTL-2011 VHF:
134-174 MHz, 40 Watt
FTL-7011 UHF:
400-512 MHz, 25 Watt



FT-80C HF SSB Transceiver
20 Channels, 1.8-30 MHz

Vertex commercial communication products have been recognized worldwide for over 4 decades for technical innovation and rugged reliability.



VHF/UHF Repeaters
VXR-5000 – RF Synthesized 136-174 MHz, 400-512 MHz, 25 Watt (shown.)
FTR-2410A, 136-174 MHz, 10 Watt (RF); FTR-5410A, 430-512 MHz, 10 Watt (RF) (Not shown.)

So, put a "seasoned" pro to work communicating for you. Contact your Vertex dealer or call today for details – then switch to the Vertex Line. It's complete and competitive.



United States: Yaesu U.S.A.,
(310) 404-2700

Central & So. America:
Yaesu International Sales,
(305) 593-2500

Canada: Omni Provincial Electronics
(800) 567-6664

© 1993 Yaesu U.S.A.



To make Vertex products even better, they're backed by a 3-Year Warranty on all products and Authorized Service Representatives are just a phone call away.



FP-711 Power Supply
(Base Station configuration shown.
Radio and MD-11A8J Desk Mic not
included.)

Specifications subject to change without notice.



ID-8 \$89.95

Automatic Morse Station Identifier. Meets all FCC ID Requirements. Fully field programmable with included keypad. 1.85" x 1.12" x .35"



CC-1/CR-1 \$49.95 each

Surface Mount Component Kits for repairing SMT circuits. CC-1 for capacitors/CR-1 for resistors.



TP-38 \$399.00

Shared Repeater Tone Panel. Full function, microprocessor controlled. 19.0" x 1.7" x 6.0"



TE-64 \$79.95

Self-contained Encoder, Rotary Dial Selection. Great for the Benchtop. 5.25" x 3.3" x 1.7"



TE-12P \$89.95

Self-contained CTCSS or Burst Encoder. Each dial position is field programmable. 5.25" x 3.3" x 1.7"



PE-1000 \$224.95

Desktop Paging Encoder. Two-tone sequential, other formats available. 7.5" x 7.8" x 2.7"



PE-2P \$54.95

Two-tone Sequential Encoder. Sub-assembly mounts inside radio or other enclosure. Multiple call capability. 1.25" x 2.0" x .4"



SD-1000 \$59.95

Two-tone Sequential Decoder. Programmable unit provides switched outputs from two-tone paging calls. 1.25" x 2.0" x .4"



DTD-1 \$59.95

Single Function DTMF Decoder. Provides switch outputs via DTMF. 1.25" x 2.0" x .4"



PE-4/PE-15 \$99.95

Multiple Call POCSSAG (RPC-1) Paging Encoders. Where direct control of local area paging is desired. 1.78" x 1.03" x .35"



DCS-23 \$59.95

Digital Coded Squelch Encoder-Decoder. Programmable to all codes. 1.36" x 1.18" x .25"



TS-32P \$57.95

Programmable CTCSS Encoder-Decoder. Tone squelch for any FM transceiver. 1.25" x 2.0" x .4"



TS-64 \$64.95

Sub-miniature Programmable CTCSS Encoder-Decoder. 1.7" x .78" x .25"



SS-32SMP \$27.95

Sub-miniature CTCSS Encoder. Jumper programmable. .53" x 1.0" x .16"



SS-32PA \$28.95

Programmable CTCSS Encoder. Custom tones or audible tones also available. .9" x 1.3" x .4"

The Sky's The Limit!

For over 25 years... bringing you tone signalling products that are as reliable as the day is long. Combine this with same-day shipping, toll-free technical support, and our no hassle one year warranty, and you'll realize the

sky's the limit in our efforts toward customer satisfaction.

Shown are a few of our most popular tone signalling

products. Call for details on these and all your tone signalling needs. A free catalog will be mailed upon request.



COMMUNICATIONS SPECIALISTS, INC.

426 WEST TAFT AVENUE • ORANGE, CA 92665-4296
LOCAL (714) 998-3021 • FAX (714) 974-3420
ENTIRE U.S.A. 1-800-854-0547 • FAX 1-800-424-3420

